DOCUMENT RESUME

ED 356 408 CE 063 516

AUTHOR Turner, Terilyn C.
TITLE Literacy and Machines: An Overview of the Use of Technology in Adult Literacy Programs. Technical Report 93-3.
INSTITUTION National Center on Adult Literacy, Philadelphia, PA.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE Apr 93
CONTRACT R117Q0003
NOTE 75p.
PUB TYPE Information Analyses (070)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Adult Basic Education; *Adult Literacy; Adult Students; Computer Software; *Computer Uses in Education; *Educational Philosophy; *Educational Practices; *Educational Technology; *Literacy Education; Programed Instructional Materials; Teaching Methods

ABSTRACT

Issues related to the use of technology in literacy programs, such as how decision makers can sort through the claims made by hardware and software vendors and how scarce resources can be found to purchase technology, are the focus of this report. The paper also provides a framework for incorporating technology into the curriculum. It gives a brief overview of the history of technology use in adult literacy programs and identifies the philosophical positions that enhance and limit the use of technology. Research and recent developments in the field also are cited. A summary of current applications of technology encompasses community-based programs, family literacy, workplace literacy, and adult basic education programs. Issues and future projections for the development of technology are presented. A bibliography lists 78 references. Two tables present a comparison of integrated learning systems and curricular systems and matching program needs with software; a figure illustrates uses of technology in adult literacy programs. (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED356408

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

LITERACY AND MACHINES:
AN OVERVIEW OF THE USE OF TECHNOLOGY IN ADULT LITERACY PROGRAMS

Terilyn C. Turner
Saint Paul Lifelong Literacy

TECHNICAL REPORT TR93-3
APRIL 1993

This report was developed under the NCAL Policy Series Project.

This work was supported by funding from the National Center on Adult Literacy at the University of Pennsylvania, which is part of the Educational Research and Development Center Program (Grant No. R117Q0003) as administered by the Office of Educational Research and Improvement, U.S. Department of Education, in cooperation with the Departments of Labor and Health and Human Services. The findings and opinions expressed here do not necessarily reflect the position or policies of the National Center on Adult Literacy, the Office of Educational Research and Improvement, or the U.S. Department of Education.

NATIONAL CENTER ON ADULT LITERACY, 3910 CHESTNUT STREET, PHILADELPHIA, PA 19104-3111

BEST COPY AVAILABLE

CE063516

TABLE OF CONTENTS

ABSTRACT	
INTRODUCTION	1
HISTORICAL PERSPECTIVES	3
CONTEXT FOR ADULT LITERACY	11
AVAILABLE TECHNOLOGIES	19
CURRENT USES	29
PROGRAM APPLICATIONS	35
ISSUES IN THE USE OF TECHNOLOGY	47
FUTURE PROSPECTS	59
FINAL THOUGHT	65
REFERENCES AND GENERAL BIBLIOGRAPHY	67
APPENDIX	A-i
Table 1	A-iii
Figure 1	A-vi
Table 2	A-vii

LITERACY AND MACHINES:

AN OVERVIEW OF THE USE OF TECHNOLOGY IN ADULT LITERACY PROGRAMS

Terilyn C. Turner
Saint Paul Lifelong Literacy

ABSTRACT

At a time when literacy is attracting widespread recognition as a critical national issue, technology adds a new and complicated dimension to the literacy debate. How can decision makers sort through the claims made by hardware and software vendors? How can scarce resources be found to purchase technology? This paper addresses these issues as well as provides a framework for incorporating technology into the curriculum. It gives a brief overview of the history of technology use in adult literacy programs and identifies the philosophical positions that enhance and limit the use of technology. Research and recent developments in the field are also cited. A summary of current applications of technology includes community-based programs, family literacy, workplace literacy, and adult basic education programs. Issues and future projections for the development of technology are presented.

INTRODUCTION

The application of technology to the field of adult literacy has occurred with such speed that there has been relatively little attention paid to the antecedents of this movement and to links with larger themes found in adult literacy and in technology. The fields of adult literacy and technology are so new that there is a tendency to view issues as arising Venus-like, fully formed, without precedent or context. Understanding the roots of current practices provides a needed frame for decision-making. The confluence of adult literacy and technology is the point where two distinct, embryonic fields meet. Like most great mergers, it is fraught with turbulence, excitement, and potential.

Conferences, books, and symposia have been devoted to forming adequate definitions of literacy and technology. As academics debate meaning, administrators are buying computers, teachers are using software, and learners are, hopefully, learning.

Literacy has been defined as the ability to read and write, functional literacy as the ability to read and write in a particular context. After that, it all gets very hazy. Definitions of literacy abound with special meanings: workforce, workplace, functional context, family, and English as a Second Language. One author, in an attempt to elucidate meaning, refers to the common definition as "plain, vanilla literacy" (Venezky, Wagner, & Ciliberti, 1990).

Technology shares a similar fate. Initial definitions in adult literacy literature referred to "computers" (Cole, 1971) and were so limiting that many potentially useful technologies were ignored as part of a broader perspective on the use of machines. Conversely, and more recently, the field of technology has been defined so broadly that it includes textbooks, calculators, and copy machines. This is equally problematic when trying to define the need, analyze the situation, and make recommendations.

HISTORICAL PERSPECTIVES

When teachers are asked to remember their first use of technology, they smile, look off into the distance, and begin to tell a story. The machine described is likely to be a talking typewriter, controlled reader, or opaque projector. Often the story is one of initial confusion and frustration, followed by problem-solving, and culminating in a successful experience for teacher and student. As one Laubach tutor said when hooking together numerous wires to create a demonstration lab at a conference, "Do you know why you do it? You do it because once you've seen what happens to your student, you can never go back."

The use of technology in adult literacy programs began largely through experimentation by innovative and creative practitioners who were attempting to meet the needs of their learners. In the 1950s, volunteer tutors and adult literacy teachers scrambled to find materials that would work with adults. Often teachers and tutors used materials designed for children and edited them for their students. The newspaper was a key curricular material because it did not embarrass the adult learner, was inexpensive, and contained interesting material (Newman & Beverstock, 1990). Frequently teachers turned to tapes and tape recorders to relieve the tedium of drill and practice. Some teachers also used the language master, developed for elementary students, to augment their instruction of English and basic vocabulary through the use of sound. From the outset, sound was viewed as a critical element technology could provide.

Teachers in reading labs in community colleges and vocational schools often came to technology by way of reading machines. Developed during World War II to train pilots, tachistoscopic readers enabled teachers to regulate the speed of the printed word. Part of the speed reading courses taught in the 1960s and 1970s became a standard part of reading labs for adult learners in community settings. One of the attributes of this technology was the ability to alter and control the instructional environment, a precursor to the current discussions of using virtual reality to create literacy worlds.

In the 1960s and 1970s, the use of computers for adult literacy instruction began on an experimental basis. Early projects used

mainframe computers, hooked through telephone lines to terminals located some distance from the computers themselves. These experiments resulted from training programs developed during World War II (the Link Trainer) and the advancement of the technology itself to a point where it was feasible to deliver instruction across distances.

Although the military provided a leadership role in the development of basic skill software in the 1970s, the material was unavailable to the general public. When made available through technology transfer grants in the 1980s, it was found that much was military (or context-specific) and largely unusable by the public. Computer-assisted instruction (CAI) initiated through experimental projects at large universities such as the University of Illinois, Harvard, and Pennsylvania State University, was used on a limited basis to teach basic skills to adults (Cook, 1977). Through these experiments and those of the military, the potential of technology for use in basic skills instruction was first articulated. The promise of technology to provide individualized instruction, relieve the tedium of repetitive tasks, and present new content beyond the capability of the individual teacher or tutor was envisioned from the outset (Cole, 1971).

The first major release of a commercial product to teach basic skills to adults was PLATO (Programmed Logic for Automated Teaching Operations), developed by the Control Data Corporation. In cooperation with the University of Illinois and the National Science Foundation, PLATO was released to the public in 1975. Used on an experimental basis in numerous projects, PLATO provided both CAI and computer-managed instruction (CMI) designed to deliver basic skills (among other content areas) to adults. Data collected in many of these projects provided a beginning for research in the application and use of technology for delivery of instruction to adults needing basic skills. The underlying assumption behind the PLATO system was that the content to be learned is fixed, while instructional time can vary. Such an assumption was viewed as a major departure from traditional instruction where class time is constant but the amount learned varies (Worthy, 1987).

The fixed-content/variable-time concept matches well with competency-based instruction and a view of education that emphasizes mastery learning. Mastery learning is grounded in the guiding principle that the learner should achieve mastery at one stage before moving on to the next. Tracing its origins to B. F. Skinner and behaviorism, the view places strong emphasis on adapting instruction to the individual through development of

an appropriate curriculum. Materials are arranged in progressively more difficult units that allow the individual to master one concept before moving on to the next. Individual differences are viewed as a basic problem of curriculum design. Benjamin Bloom addressed this point by suggesting the possibility of eliminating individual differences through repeated cycles of mastery learning (Hilgard & Bower, 1976).

The computer is an excellent solution for curriculum developers who need to handle vast amounts of discrete information. The underlying philosophy of mastery learning assumes that knowledge is sequential, incremental, and can be broken into parts. Such a learning theory is a perfect match for programmers who need to write software that follows a logic that can be understood by a machine. Thus, nearly all the early CAI programs were competency-based, laid out a curriculum that showed clear scope and sequence, and were readily interpretable to funders and programmers alike.

The sequential learning theory continues as a basis for software design and underlies competency-based print materials such as reading kits that provide a "scope and sequence" overview for their curriculum. It also fits with the Adult Performance Level (APL) study that was completed in 1977 by the U.S. Office of Education. The APL study was designed to define functional competency by identifying the skills needed to meet the requirements of adult living. The skills identified by the study have been and continue to be the basis for curriculum development in adult literacy. Testing programs, such as California Adult Student Assessment System (CASAS), also have relied heavily on APL standards. Other taxonomies have been developed that identify the "basic skills" required for literacy. Such classifications, in turn, have been used to design software that addresses the skills identified as necessary for survival. Mastery learning supports the belief that given enough time, most people can learn.

The mastery theory also fits well with the second chance philosophy of community colleges and vocational schools. The belief that "given enough time, most people will master anything" has been a part of developmental education since its inception (Roueche & Snow, 1978). Consequently, community colleges and vocational schools have been major purchasers of PLATO and other CAI systems since the 1970s. Correctional facilities, as well, have used CAI to deliver instruction that was

unavailable through a classroom format and to provide a new way of learning.

One of the greatest problems of the original PLATO system and other CAI on-line systems (aside from down time due to storms and software glitches) was the expense. At a leasing cost of $30,000 a year in 1979, institutions chose to hire another teacher. One study using an IBM system found that the cost per pupil hour was more expensive than conventional systems of instruction. The question was raised as to whether CAI should be used at all. The report concluded, "CAI in its conventional forms should not be explored any further at present for Adult Basic Educational (ABE) students" (Cole, 1971, 53).

A legacy from the CAI period was an awareness that the PLATO "bulletin board," which allowed learners to communicate with each other, was the system's most popular feature, not the instructional materials themselves. Such internal communication foreshadowed the more recent use of bulletin boards, electronic mail, and networking as instructional tools by adult literacy providers and learners.

Despite the fact that technology is now viewed as an accepted part of schooling for children, with debates focusing on differential access, cost, and appropriate utilization, the use of computers for adults has continued to meet resistance. The resistance to technology by adult educators has been attributed to the sharp contrast between the underlying philosophy of adult education and that of computer instruction. The field of adult education is highly humanistic and process-oriented, emphasizing internally driven goals and objectives and sharply contrasting with the behavioral approach found in most software design. The product orientation, competency-based skill development of most software programs is rejected by many adult educators (Meierhenry, 1982; Vacc, 1984). The work of Paulo Freire, Malcolm Knowles, and other noted adult educators focuses on the whole person and the total learning environment and emphasizes a holistic, or gestalt, approach to instruction. Thus, technology as a means of instruction that does not embrace the whole person is viewed as suspect at the outset.

The advent of the microcomputer in the early 1980s caused many adult educators who had rejected CAI to take another look at the use of technology for basic skills instruction. The self-contained units of instruction allowed a flexibility previously not available with the on-line terminals. They were portable and relatively inexpensive. Advances in technology, lowered cost of

software and hardware, and greater availability opened new possibilities in the area of basic literacy instruction. Teachers and tutors pioneered ways to use the microcomputer long before national organizations—such as National Affiliation for Literacy Advance (NALA), now Laubach Literacy International (LLI), and Literacy Volunteers of America (LVA)—or the U.S. Department of Education provided encouragement or assistance.

Developing along a separate track, distance technology made strides with delivery of instruction through television. Although television has been used more frequently as a means of proselytizing and publicizing adult literacy, there is a strong tradition of its use as a medium for instruction. Surprisingly to many U.S. educators, much of the best material for adult literacy distance delivery has been developed by and for other nations. The British Broadcast Corporation (BBC) developed several excellent literacy instructional programs during the 1970s. The use of close-captioned television, long a boon for hearing-impaired learners, is viewed increasingly as a significant teaching tool for those needing basic literacy skills. One study conducted on close-captioned utilization found that primary users were adults learning English (NCI, 1988).

Kentucky Educational Television (KET) has been delivering the KET/GED series on broadcast television since the early 1970s. The original format has been expanded to include telephone and correspondence support, videotapes, and interactive-video capability. The content was updated in 1986 when the General Education Development (GED) test was revised. Involved in the development of technology at an early stage, KET continues to provide leadership in pioneering new technological solutions through production of video curricula for adults as well as offering teleconferences for practitioners (KET, 1992).

Official support for the use of technology in adult literacy instruction can be dated back to Nickse's seminal paper in 1983 entitled, *The Case for Use of Micro Computers in Adult Basic Education*, sponsored by the National Advisory Council on Adult Education. Under section 310 of the Adult Education Act, states are required to spend at least 10% of their federal ABE funds for innovative efforts. A review of these activities in 1984 revealed that only 17 states sponsored computer-related projects with these funds, and most of them were for CMI rather than instruction (BCEL, 1985).

The picture was considerably brighter in some states. Massachusetts had a statewide plan to introduce computers in all of its ABE programs. Some states formed consortia to support computer technology, most notably the Northwest Consortium of Oregon, Washington, Idaho, and Alaska which pioneered a systematic process for software review. Major strides in the area of research and software development were made by the Institute for the Study of Adult Literacy at Pennsylvania State University in the 1980s.

Community colleges, vocational schools, and correctional facilities began experimenting with computer labs specifically designed to teach basic skills. Notable was the Adult Basic Literacy Education (ABLE) Center, sponsored by Central Piedmont Community College in Charlotte, North Carolina, which opened in 1983. The original lab model, which used 32 microcomputers to deliver basic skills instruction in a shopping mall, was revised and expanded to other states as a way of reaching learners who had not sought help previously.

Significant contributions to the field of adult literacy and technology have come from movements outside of but parallel to the field: (1) the Project Plus Campaign and (2) libraries. For example, Project Plus sponsored by PBS and ABC, focused new attention on the value of technology in recruitment of learners and volunteers. The library's massive effort, first in California and then nationally, has committed millions of dollars to the field of literacy. Through Title VI of the Library Services and Construction Act (LSCA), new technologies have been purchased for literacy projects in libraries (Main, 1991). The U.S. Department of Labor's concern for a literate workforce has prompted millions of dollars to be directed towards workforce literacy, and some of that funding has supported technology.

In June, 1985, the Gannett Foundation sponsored an invitational meeting for 50 literacy professionals interested in the use of computers in literacy instruction. During the session the group expressed the need for a national network to promote the use of computers in literacy programs, share information among interested individuals, and plan for the future. The result of the meeting was the establishment of the Adult Literacy and Technology Project located at the Institute for the Study of Adult Literacy at Pennsylvania State University. A newsletter was published, national conferences were held, technology consultants were trained, and a network was established. Although the project itself no longer exists, many of the individuals who attended the first invitational meeting continue to be leaders in

the field of adult literacy and technology, and the national conference continues to feature major breakthroughs in the field.

At the 1992 Adult Literacy and Technology Conference, over 30 vendors displayed software targeted for the adult literacy market. Some of the more interesting new technologies presented during sessions included: interactive video for GED, adult literacy telecommunication networks—America On-line and Outreach and Technical Assistance Network (OTAN)—group response technology (Discourse system), and multimedia technology for diverse populations. In 1991, the U.S. Department of Education funded a major research center for adult literacy, the National Center on Adult Literacy (NCAL). NCAL is responsible for conducting research and producing policy-oriented papers to assist decision-makers at the state and federal level. One of the major areas of interest for NCAL is technology and its application to the field of adult literacy. To this end, a technology laboratory was established at NCAL, several technology symposia have been held, and research papers are being published.

The current state of adult literacy and technology is one of flux. When it comes to technology, programs that could afford computers five years ago can no longer pay for the staff to run them. Funding constraints have caused many literacy providers to stop purchasing computers, or worse yet, the programs have ceased to exist. Many of the projects described earlier (such as the one in Massachusetts) no longer exist. A recent study indicated that the desire for funding for hardware purchases was a need felt "across the board" for literacy organizations. Funding was the single biggest reason adult literacy programs lack technology and "funds that are currently available are insufficient" (Sivin-Kachala & Bialo, 1992).

Lack of funding is the case, despite the fact that there is increased support for using technology as well as significant developments in the field itself that make it increasingly viable as the instructional medium of choice.

CONTEXT FOR ADULT LITERACY

Increasing attention is being paid to the context for all instructional and learning activities. The growing realization is that *school*—as it has been classically conceived as an institution bounded by organizational roles, values, and norms distinct from those of other institutions such as family and church—now faces the ideological challenge of schooling as preparation for life. There is a growing awareness and acknowledgment that what school prepares one best for is more school (Gardner, 1991; Kozol, 1991). The majority of adult learners found in literacy programs did not do well in school.

Likewise, an understanding of the larger cultural context in which literacy resides demands a view of adult learners as capable of succeeding, communicating, and surviving with or without literacy instruction. The cultural perspective values the adult learner's ability to articulate needs, define goals, and frame the instructional process. Such understandings parallel a view of reading as the creation and construction of meaning from print. The rationale of adult literacy educators who view technology as a means of empowerment encourages learners to create the context for their own instruction.

Professionals in adult literacy have been promoting the use of computers since the early 1980s. Articles by Nickse (1981), Duffy and Bowen (1986), Askov (1985), and Turner (1984) have strikingly similar themes, despite differing technologies applied to different populations which have different goals. In the 1990s, similar findings are being replicated in reports from Australia, France, and Great Britain. The value of technology for adult literacy instruction can be organized under five key headings: privacy, control, individualization, feedback, and flexibility.

1. PRIVACY

The stigma associated with illiteracy and the desire for privacy is difficult to overstate. Numerous television shows have graphically portrayed how individuals strive to hide their need for better literacy skills. While the media can also create problems in this area, they have raised the consciousness of

learners and teachers alike to the larger societal discrimination ascribed to illiteracy.

As a result of years of frustration and abuse in learning environments—frequently called *schools*—adults seek privacy in a learning situation. The adult learner's desire for privacy has long been understood by volunteer literacy programs such as LLI and LVA. By providing one-to-one instruction, a volunteer tutor minimizes the amount of public acknowledgment necessary for the adult learner. ABE has been less sensitive to the privacy issue with its continuation of the classroom as the appropriate context for instruction. Anxiety over classroom participation is one of the significant ways adult learners differ from children; many adults seek privacy in the learning situation (Kozol, 1985, pp. 30-50).

Technology affords the privacy that adult learners seek. There is no question of winning over the teacher or tutor. The teacher is no longer the person who approves work and is thus no longer open to all the learner's frustration and aggressiveness. For many learners, the teacher and peers were the source of humiliation in a classroom setting. Technology frees knowledge from its usual emotional context and negative prior associations (Berterreix, 1990).

The fear of ridicule and the reality of discrimination in the form of job lay-off or job denial are powerful reasons for adult learners to resist group instruction. In contrast to the reality of aversion to group consequences, educators are trained in group dynamics, managing group instruction, and receive the majority of their reward in teaching from performing before a group (Schlechty, 1976; Lortie, 1975).

Learners articulate the following views of technology as a means of achieving privacy in projects from around the world:

> *France:* "There's no one looking over my shoulder telling me what to do." (Berterreix, 1990, p. 415).
>
> *Saint Paul, MN:* "I tell people I'm coming to my computer class. I would be embarrassed to say I was going to learn to read, but it's great to tell friends I'm going to my computer class." (Patton, 1987, p. 64).
>
> *Richmond, CA:* "Mr. Griggs indicated that, as long as someone 'got him started,' he would have used

> the computer...even if Susan (his tutor) hadn't been there. Eventually he would have preferred to be able to come into the Learning Center alone and make his own decisions" (LEAP, 1986).

The role of privacy in adult literacy instruction should not be construed to mean isolation. On the contrary, learners are increasingly using electronic networks, fax machines, and video to share information and communicate with learners in other parts of the country and the world. The terms *school* and *community* find new definitions as they are created through technological networks (Turner, 1991). The privacy afforded by technology allows learners to participate cooperatively in the educational process when and if they choose to do so.

2. CONTROL

A major theme for adult literacy in the 1990s is learner empowerment. Framed somewhat differently depending upon the author, the concept places the learner at the center of the educational process (Kozol, 1985; Fingeret, 1991). Learner empowerment changes the role of the teacher and the learner so that the teacher is no longer the dispenser of wisdom and the learner is no longer the sponge soaking up knowledge. Instead the learner is viewed as the architect of his or her own educational plan with assistance provided by the teacher or tutor.

Learner empowerment works well with technology since technology places control in the hands of the learner, not the teacher. For many adults it is the first time they have been in charge of the instructional process. Technology enables learners to make decisions about what they will learn and how they will learn. Traditionally learners have been told what to read and what to write, how many times to practice the multiplication tables, and how often to do it. Caring teachers and tutors become fatigued by repetitive instruction required by many basic literacy learners. Learners can practice as much as they desire without pressure to move more quickly or slowly from a teacher, tutor, or class.

Learners explain their new-found learning processes in many ways:

> Saint Paul, MN: "In school people give you a hard time. They control you. Here you control yourself. You come to learn" (Patton, 1987. p. 66).
>
> France: "The computer doesn't get my goat. It doesn't make me feel stupid" (Berterreix, 1990, p. 415).
>
> Australia: "While students curiously had few reservations and have taken to the touch screen and self-access program with gusto, teachers are somewhat circumspect" (Anderson, 1991, p. 126).

Schools have taught students to be dependent and wait their turn. Learners in adult literacy programs must be taught not to wait for the instructor before hitting the return key on a computer or moving ahead in the instructional process.

3. INDIVIDUALIZATION

The capability of individualizing instruction specific to a single learner's needs is for many the Holy Grail of education. Sought after since Plato, it continues to elude its most ardent devotees and is more likely to be found in curriculum design textbooks than in actual classroom activity. Mary Alice White of Columbia University stated that the advent of technology has challenged curriculum design as it is practiced currently in public education in the U.S. The challenge is a result of the branching capability of the computer that allows instruction to be modified according to learner response. Thus, instead of the linear, two-dimensional scope and sequence design familiar and standardized in most disciplines, technology introduces a third dimension—depth—created by the learner's response and the ability of the computer to move in multiple directions based on that response.

The implications for adult literacy are direct and profound. Adult literacy programs operate with the assumption that the curriculum must be individually designed for each learner simply because there is no alternative. No two adults entering a literacy program arrive with the same educational background,

identify the same goals, or have the same needs. Thus, it is incumbent upon the teacher or tutor to construct an educational program or individual learning plan for each student.

Technology increases the likelihood that the individual program design will actually happen. Instruction can be individualized not only in terms of achievement level but also in reference to the specific interests and abilities of learners. Materials can be developed, altered, and tailored to the needs of individual learners in ways that workbooks and textbooks cannot. The use of CD-ROM encyclopedias and hyper-application activities that enhance analytical reasoning is currently being incorporated into literacy programs on a limited basis throughout the country.

Learners are aware of the technological capability and provide insights into the value they place on its attributes:

> Saint Paul, MN: "You go at your own pace. I liked the individuality. You take your own time. Nobody is pushing you. You're learning the computer and reading at the same time" (Patton, 1987, p. 64).
>
> Clarksburg, MS: "[The computer] helps me learn one step at a time" (Main & Whitaker, 1991, p. 25).
>
> Richmond, CA: "I know I will know more when I leave here. I feel more and more excited about knowing more." She feels the computer can simplify the lessons she needs to have and has the sense that the programs reinforce and broaden her knowledge (LEAP, 1985).

4. FEEDBACK

Descriptions of the value of technology for adult literacy instruction frequently mention the ability of the computer to provide the learner with immediate feedback (Sivin-Kachala & Bialo, 1992; Guellette, 1982; Anderson, 1991). Feedback is a term often used by adult learners to describe what they like best about working with the computer. Students describe their past school experiences as frustrating because they were out-of-sync with the other students. Often they needed more individual attention than even exceptional teachers could give. In some cases students were

ahead of the class and became bored waiting for others to catch up. In contrast to such prior experiences, the active response required by the computer enables the adult learner to be totally engaged in the educational process.

The role of feedback in learning through computer-based instruction is a much researched, heavily debated topic. Whether feedback should be immediate or delayed to promote retention and whether the feedback function provides reinforcement in addition to information, are the subjects of numerous research studies (Carter, 1984; Cohen, 1985; Gaynor, 1985). It is worth noting that these studies have been conducted on pigeons, rats, and children, rather than on adults (Knowles, 1973). Learning studies conducted on adult literacy learners working on computers are virtually non-existent.

Whether the role of immediate feedback in the learning process is motivational, informational, or one that enhances retention, learners describe their experience clearly:

> *France:* "Self-correction is great. You find your mistakes yourself and there's no teacher marking you. You don't get discouraged like you do in school" (Berterreix, 1990, p. 415).
>
> *Saint Paul, MN:* "The instant feedback is great. You don't have to wait for teachers to check" (Patton, 1987, p. 65).
>
> *Richmond, CA:* "This is much easier with a machine than with a tutor, doing the same thing over and over...[Computers] let you know when you do something wrong and they reward you when you do it right" (LEAP, 1986).
>
> *Australia:* "School was the pits; I was stuck in the opportunity class. It was boring. I couldn't sit down with a piece of paper and study; it was no challenge at school. Computers have made a lot of difference to me" (Anderson, 1991, p. 49).

5. FLEXIBILITY

The potential of technology has yet to be fully realized in its promise of continuous instruction. The fact that all technologies can be made available 24 hours a day, at any time or any place, has yet to be totally appreciated as a solution to some of the major educational issues confronting society today. In the adult literacy arena, matching learners to tutors and classroom schedules has proven a baffling problem. Instruction continues only as long as the tutor and learner can meet. Learners attempt to get to class while holding down several jobs, raising children, caring for elderly, and coping with the exigencies of daily living. Given the highly complex and difficult lives of most adult literacy students, 50% attrition rates are common in adult literacy classrooms.

The flexibility that works well for adult learners also works well for volunteer tutors and teachers, who can stagger their schedules to meet a wider range of options for supporting literacy instruction when technology is employed. The delivery of instruction in a variety of settings, including learning labs, libraries, homes, and offices, is just beginning for adult literacy learners. The capability through satellite dishes, fiber optics, and fax of worldwide delivery of instruction 24 hours a day is a dream that is yet to be realized.

Learners understand and appreciate the flexibility technology affords:

> Australia: "Because of this language problem, I wouldn't be able to manage going into an ordinary class; it all gets jumbled. In a situation with lots of information, I can't cope; I have difficulty. But with a computer I can just walk away from the machine and come back later!" (Anderson, 1991, p. 49).

> Saint Paul, MN: "There's not the hassle from kids like there is in a school. Here, it's just like you're going shopping and you go at your own convenience. It's open all the time" (Patton, 1987, p. 65).

> Clarksburg, MS: "[The computer] allows for flexible scheduling. I can work at my own time and pace" (Main & Whitaker, 1991, p. 25).

AVAILABLE TECHNOLOGIES

Before proceeding with an analysis of technology types, it is important to caution the reader on the limits of this discussion. First, all technology descriptions must be viewed as suspect six months after publication. (The six months time frame was also used recently by John Sculley of Apple Computers when asked to define the limits of his predictions.) Areas where change is likely to occur include: price, new software developments, new hardware developments, company mergers, company closings, and product acquisitions. Second, hardware and software discussed are specific to the United States and may have limited utility in countries where the product may not be available.

1. INTEGRATED LEARNING AND CURRICULUM SYSTEMS

Integrated learning systems (ILSs) exemplify technology at its best and at its worst. An ILS is a comprehensive instructional package that employs technology to offer a basic skills curriculum and management system for students. At its best, the ILS offers a literacy program a way to provide an innovative approach to instruction, a standardized, carefully developed curriculum, and a systematic assessment and evaluation process. At its worst, the ILS offers rigid drill and practice exercises with scant attention to context, unfulfilled promises of accountability, and expensive hardware and software problems.

The good news is that the options offered in ILSs have expanded exponentially in the last few years; the bad news is that such options are complex, and the selection process is somewhat daunting. More good news comes with an increase in platform standardization of new product developments focused clearly on the Mac or MS-DOS with Windows capability (Sherry, 1992). The increased development of open architecture software for the ILS provides the teacher or tutor flexibility previously experienced only with stand-alone packages. Teachers who were disappointed with the former rigid ILS structures should take a second look at current offerings that include word processing, notebooks, individually designed worksheets, and third party software.

Purchasing ILSs or curriculum systems can often be a daunting proposition for literacy providers. Understanding purchasing

options, as well as the legal limits of contracts, is complicated and difficult for seasoned technology users. Those unfamiliar with legal jargon and unable to predict their future needs can make expedient but unwise decisions. Advice should be sought from schools or colleges familiar with contract negotiations.

Hardware purchases, ILSs, and curricular systems are usually available through outright purchase, lease-purchase, or lease agreement only. As a general rule, leasing is preferred when funding is stable and can be projected for future technology purchases. This allows a literacy project to take advantage of the vendor's upgrades or newer products that will be developed. Conversely, if the funding is soft, it is often better to purchase the technology outright. Otherwise the program may be unable to make future payments as part of a licensing agreement. Licensing is a legal agreement that specifies the rights and obligations of the individual who purchases the program and the limits of liability for the vendor (Que, 1992, p. 560).

The complexity of licensing arrangements is an issue to be addressed in the future. At present the K-12 model of site licenses purchased for a district or school does not serve the adult literacy field well. As literacy project directors become sophisticated users of technology, they will increasingly demand the right to use software as it is needed and with more complicated configurations between the initial vendor and third party software authors who are not part of the ILS package. Usually two vendors (hardware and software) configure the licensing arrangement. The third party represents software that is desired by the user or suggested by the initial vendor. For example, an ILS may provide excellent instruction in multiplication but not meet learners' needs in fractions. A package that has previously been used successfully by the literacy project for fractions may be desired as part of the ILS. If the third party software is to be integrated into the management system, the configuration requires negotiation for an equitable contract among all parties in a licensing arrangement, which is a difficult and time consuming process.

Likewise, software that accommodates the needs of a classroom environment fares poorly in the rough and tumble world of adult literacy where learners need to be grouped according to program or instructional design, not according to teacher or class. ILSs designed for K-12 grades may be inappropriate for adult literacy needs. The emphasis on class can create artificial categories for literacy learners. Some software programs are unable to collect information by the

minute and are programmed only to recognize days and class hours (50 minutes). Major problems arise when literacy providers attempt to report results. Likewise, electronically enrolling every learner in a class delays access to instruction because the management system creates an artificial barrier. The process can be equally frustrating to teacher and learner when teachers are forced to "purge" classes to make room for new learners. In the K-12 system teachers rarely have more than 250 students; in adult literacy numbers commonly exceed 2500.

The decision to purchase an ILS is frequently one of necessity. ILSs are particularly appealing to new or rapidly expanding literacy programs. An ILS provides an instant curriculum and an operating system that facilitates use for both teachers and learners. In correctional facilities, the military, and workplace environments where individualized instruction must be available at all times of the day or night, ILSs provide the answer. The capability of many vendors to provide a turn-key operation is also a major selling point. A new literacy program that must be operational in a short period of time rarely has the personnel to design a curriculum as well. The quality of ILSs has improved dramatically as technologies have developed that offer sound, full motion video, and recording capabilities.

A comparison of current ILSs must begin with the caveat that software and hardware vendors continue to merge and split at a prodigious rate. It is important to know the historical development of any product, as well as the vending company, to determine future viability; vendors who no longer exist rarely make provisions to support their software and hardware.

Table 1 (see Appendix) provides a comparison of some of the comprehensive learning systems currently on the market. More extensive comparisons can be found in technical journals and as part of research reviews (Sherry, 1992; Sivin-Kachala & Bialo, 1992), but usually focus on the use of ILSs within the K-12 environment. It is important to note that most, but not all, ILSs were developed for use in K-12 schools, placing a burden on the reviewer to check carefully for appropriateness in an adult literacy program.

The granddaddy of ILSs is the PLATO system conceptualized at the University of Illinois in 1959 as an on-line system for adult learners. With support from the National Science Foundation and the Control Data Corporation, courseware for dozens of curricular areas was developed. The total development cost of the PLATO product from 1963 to 1980 was $900 million (Worthy,

1987, p. 104). The enormous investment, even by today's standards, includes a vast number of hardware and software projects not necessarily for adult education.

PLATO is a general purpose system, including the TUTOR authoring language and other tools. Now being developed and distributed by TRO Learning, Inc., PLATO 2000 continues to supply a greater number of instructional hours than many competitors on the market. It has phenomenal branching capability as well as tutorial instruction that is appealing to learners and teachers alike. The software has changed and improved as well. PLATO is now in color with new software delivered through CD-ROM.

Another local area network that has longevity and thus can provide significant research data to support its claims is the Computer Curriculum Corporation (CCC). The CCC offers extensive coursework in adult literacy instruction. Originally developed by Patrick Suppes, director of Stanford's Math Institute, the CCC is found in many occupational programs and prisons as part of the vocational curriculum. The CCC has some unique features that make it particularly appealing for adult literacy programs. Home delivery through use of the telephone is being used in family literacy programs, and the availability of ESL in six languages is unique among ILSs. The CCC has been purchased recently by Paramount Production Company, creating a great deal of excitement within the company and visions of unlimited movies integrated with computer software as part of multimedia delivery. The availability of the CCC on both MS-DOS and Macintosh platforms is viewed as another plus for this system.

Jostens is a newcomer as an adult literacy ILS provider. Commanding a dominant share of the software market, it is in an excellent position to provide leadership for new products and integrate them with existing ILSs. Having combined a number of excellent and well respected software vendors, such as Hartley, Prescription Learning, ESC, and Wicat, Jostens has developed new products as well. Although the name has not totally caught on (most refer to it as the Jostens system), Invest in the Future (known as INVEST) contains many excellent products developed independently for adult learners. Compton's Multimedia Encyclopedia is available through Jostens and is often the deciding factor for buyers. One of Jostens' challenges has been to merge software designed for different platforms and from different philosophical positions. Perhaps because of this, the

company has been instrumental in providing leadership to incorporate third party software into the ILSs.

The Comprehensive Competencies Program (CCP) is not an ILS but is frequently labeled as such. The CCP is actually a curriculum plan that incorporates technology and may use a variety of ILSs. It is often confused with the CCC, one of the ILSs it uses. Most recently known as U.S. Basics, the CCP system is recognized and well regarded in occupational circles. Links to the U.S. Department of Labor and the Ford Foundation gave this system early recognition in the field of workplace literacy. Over time it changed and developed its program assessment process and the technology used. U.S. Basics can provide assistance in the management of information for literacy projects that have extensive reporting requirements. It has a wealth of experience in working with all the existing vendors and can act as an outside broker to assist a literacy program in meeting its needs.

Principals of the Alphabet Literacy System (PALS) is also frequently confused with the technology it employs: a combination of word processing and interactive video. PALS is unique among technology systems because it is designed to address reading needs below the fifth-grade level. As a curriculum system, it was designed for at-risk high school youth. PALS, when fully implemented, represents a total laboratory concept in which the learner learns to read through an encoding process. Although not an ILS, PALS is frequently compared with ILSs on the market because it represents a major investment for a literacy program and is likely to be the primary technology purchase. Most literacy programs using PALS have adapted it to meet the needs of adult learners. Released in 1987, it continues to be one of the few products available that uses interactive video.

Other ILSs that are found in adult literacy programs include: WASATCH, known for its strong science program; and Computer Resource Systems (CRS), featuring Grollier's encyclopedia as part of its system. World Instruction for Computer-Assisted Teaching (WICAT) has been marketed independently through IBM and most recently through Jostens. The software design uses a holistic approach to reading. Less a competency-based reading program than either the CCC or PLATO, WICAT has developed and maintained a strong following among reading specialists who have been willing to overlook its K-12 orientation.

The exciting news for many familiar with the ILSs is the advent of multimedia with its blend of technologies. Multimedia is a computer-based method of communicating information, usually

combining graphics, text, and sound in an interactive format (Que, 1992, p. 404). There is a strong sentiment among futurists that ILSs as described in this paper will cease to exist. ILSs will be replaced by curricula designed and delivered through new technologies. As fiber optics, CD-ROM, and fax capability expand the capacity and extend the range of instructional delivery, the possibility of developing curricula for specific populations quickly and across geographic areas becomes increasingly feasible.

2. SOFTWARE

The backbone of technology is the stand-alone computer and its software. Software typologies usually catalogue instructional programs according to: (1) drill and practice, (2) tutorial, (3) assessment, (4) management, (5) word processing, (6) games and simulations, and (7) problem-solving. In adult literacy, the seven categories work well but have somewhat different consequences and meanings when actually applied in basic skills instruction.

For example, problem-solving programs such as *Where in the World is Carmen Sandiego?* may be difficult to integrate into the adult literacy curriculum. Software developers familiar with adult learning theory are rare, but those who are make use of the experiential background of adult learners as part of the software design. Some adult literacy professionals feel strongly that the only valid uses of adult literacy software are word processing, spreadsheets, and databases as part of a real world activity. Antonia Stone has provided major leadership in the experiential learning area in her work with *Playing to Win* in New York and Boston. Templates have been developed and are available to assist a literacy project by providing real world experiences for learners working on the computer (Learning Keys, 1992).

One avenue for free or inexpensive software is through Minnesota Educational Computing Consortium (MECC), which has licensing contracts with individual school districts and states. Many adult literacy programs are affiliated with a school or college in some capacity that would allow them access to MECC software, but they are rarely aware of such a possibility.

Others in the field of adult literacy express a need for information about free and inexpensive software as well as the establishment of a mechanism for recycling computers. Public domain software that can be copied freely is recommended for tutors and learners in volunteer programs beginning at the

lowest levels. Concern for empowerment of learners drives both the desire for free software and the use of real world applications; the belief is that those in need of literacy services are the last to receive technology and to have access to information.

3. Television, Video, and Interactive Video

The development of instructional material for television began with the KET series in the 1970s. The series has been revised, updated, and repurposed for video and interactive video and continues to be delivered on broadcast television as well as cable. KET has been a pioneer in the area of instructional television, averaging annual enrollment of 150,000 students in 48 states, the District of Columbia, Guam, Canada, and Mexico since 1975 (KET, 1992).

Internationally the BBC developed numerous literacy programs in the 1970s, serving an estimated 125,000 learners (Newman & Beverstock, 1990). Although excellent literacy materials have been developed in Great Britain, most of the materials have not been seen in the United States. Broadcast television affords the widest possible distribution of literacy instruction and, therefore, has been the medium of choice for other literacy programs such as *Learn to Read* and *The Reading Rainbow*.

The advent of video for home use and the growing VCR market created another avenue for distribution of materials originally developed for television broadcast. The development of video for adult literacy instruction has ranged from materials repurposed from products developed for broadcast delivery to creation of videos specifically for adult new readers. The use of hand-held video cameras by learners and teachers in the classroom is a significant development in instructional technology. One program developed a video pen pal program for hearing impaired refugees to communicate with a similar group in California. The use of video is currently being promoted in the K-12 classroom as a tool for authentic student assessment but has yet to be implemented in adult literacy programs.

It is interesting to note that video options are increasingly found in the catalogues of the major volunteer literacy organizations. Originally seen as a tool to supplement the training of tutors, there is a growing realization that video can be an ally for instruction of learners as well.

Interactive video combines the power of the television to mesmerize with visual imagery with the interactive capability of the computer. Brought together in one technology, interactive video has long been the technology tool of choice by many literacy specialists. What has been lacking are quality products. The situation has improved dramatically as teachers have repurposed videodiscs for use in their own classrooms and as new products have arrived on the market. It is ironic that just as products are being developed for the videodisc technology, there is a belief among some futurists that they are no longer needed with the advent of multimedia.

4. MULTIMEDIA

Multimedia, with its ability to offer sound, full motion-video, and interactivity, is the technology of choice for many literacy programs. The purchase of peripherals that will transform existing stand-alone computers or ILSs to a multimedia delivery system is a rapidly growing phenomenon. Specifically, CD-ROM drives and videodisc players are being added to existing hardware platforms. As technologies converge and merge, the lines between a medium and its capability begin to blur. Although we are not at the point where all technologies are interchangeable, it becomes increasingly apparent that literacy providers must be able to articulate their needs clearly in order for those needs to be matched with appropriate technologies.

The ability to organize information in multiple formats is finding its way into adult literacy through hypermedia and hyperapplications. Information that is organized by associative relationships is the basis for Hypercard, Linkways, and other multimedia software. According to Bill Gates, "People don't think and learn in a straight line, from one fact to another; they go off on a million tangents, because they're interested in a million things" (Blanchard, 1990). Hypermedia allows people to explore databases and access information in a way that enables them to form their own schemas on the basis of personal interests and associations. Thus, no two people will follow exactly the same path through hypermedia. Constructivism, the creation of meaning by assembling discrete bits of information or data in a nonlinear fashion, is the basis for a new way of thinking about curriculum. The curriculum is literally constructed by each learner through the transformation of information to create meaning that is personalized and learner specific (D'Ignazio, 1992).

The development of virtual realities is a case in point. Virtual reality has been defined as a "computer-generated artificial world" (Rheingold, 1991). Currently at NASA in Houston, research is being conducted to design virtual reality for literacy, i.e., develop a "literacy world." The question becomes: What does a literacy world look like? It is one thing to advocate functional context literacy and another to create the context. The capability to create the literacy context will soon be available for literacy practitioners. Therefore, it would be beneficial to engage in a long, full dialogue concerning the nature of adult literacy instruction and what, exactly, should be taught.

CURRENT USES

One of the most helpful ways to think about computers is to examine the relationship between technology and the user. A typology that establishes a three-tiered hierarchical ranking of computer usage based on the proximity of the learner to the computer demonstrates the typical process of computer acquisition and use by staff in a program: (1) management, (2) instructional support, and (3) direct instruction.

From the three-tiered perspective it becomes easier to analyze an individual program's use of technology and the selection of hardware and software. Although such an overview of the current use of technology begins with the computer, the typology developed need not be limited to computers. Rather, it is a way to think about how technology is currently acquired and used in literacy programs, as well as an opportunity to examine how it should be used to enhance adult literacy instruction (see Figure 1 in Appendix).

1. MANAGEMENT

The lowest level of the pyramid is *management*. Most adult literacy programs, whether ABE/GED, community-based, volunteer, or institutional, begin at the management level using a computer to maintain records on learners for state reports or local funders. For adult literacy programs affiliated with a state institution, fiscal information is maintained on mainframe computers and reported directly to the state or federal agencies. Student records, however, are frequently kept on microcomputers at individual sites. Smaller public and community-based organizations maintain data on microcomputers using databases and spreadsheets for reporting purposes.

A few software programs have been developed specifically for management of literacy programs and are distributed through volunteer literacy associations and state agencies. There are literacy programs that maintain records in filing cabinets and shoeboxes without the benefit of technology, but such maintenance is the exception rather than the rule as program accountability increases.

The use of technology to share information among literacy providers is a growing phenomenon. Electronic bulletin boards and other network systems are providing forums for literacy providers to share concerns and solutions, as well as to access information through databases and teleconferencing. Although network in-linking is still in its infancy, some states such as California and New York have taken a leadership role through their OTAN and America On-line systems. Electronic bulletin boards date back to the on-line PLATO system when information was shared among users. More recently the U.S. Department of Education sponsored Litline, and Apple Computer Company sponsored Applelink for literacy providers to communicate. Cost and technology glitches have limited extensive use of networks in the past, but as prices drop and accessibility increases, more literacy programs can be expected to participate.

Microcomputers are used to maintain student test scores, records and grades. In the case of literacy councils, computers may be used to facilitate student-tutor matching through zip codes maintained in databases. Word-processing is used extensively to send letters to tutors and students in a standardized format. Newsletters may be developed using desktop software to facilitate publication. Often the computer use at this level is not recognized or acknowledged as part of the program's operation since the computer may be privately owned and used by a tutor or teacher at home. Sometimes computers belong to a school or business that allows the literacy program to use them in the evening. The benefit from the technology is direct to the program but indirect and unknown to the learner.

2. Instructional Support

The next level of computer use is for *instructional support*. The computer is used to generate materials used in the classroom to support the instructional process. Word processing is used to generate tests and text materials for basic literacy instruction. Easily printed games and crossword puzzles allow teachers to enrich their teaching by supplementing instruction with computer-generated materials. Such materials can be designed specifically to meet the individual learner's needs and personalized with the learner's name. Readability formulas designed as software packages are finding their way into workforce literacy programs. The packages are also applied to materials that learners bring to class to read as a means of determining appropriate teaching strategies.

An example of the use of technology for instructional support is a language experience class in which the instructor developed a lesson on signs. After the board was filled with signs suggested by her students (e.g., stop, yield, railroad crossing), she immediately turned to a computer to generate crossword puzzles for each student. The puzzles provided a homework activity that incorporated the signs as the answers.

The computer can be used to facilitate the instructional process by supporting staff development activities. Brainstorming has been used as part of staff development workshops by utilizing software designed for such exploratory purposes. At a workshop on learning disabilities, participants split into small groups according to their particular interest. Each group used a computer to record key points of the discussion. The data from each group was combined on one disc, generated as a report, and given to all participants before the end of the workshop.

Aside from their use for networking with staff in other programs, computers can become central to curriculum development and instructional design. Parents in family literacy programs use computers to develop databases of file materials on critical issues, categorize student information, and organize lists of speakers (King, 1992). Teachers can develop curricula across time and space by sharing materials that can be tailored to individual programs and learners.

3. Direct Instruction

Direct instruction is the level at which the learner actually begins to work on the computer. A recent study found that the computer was used "as part of the instructional program in all or the vast majority of the adult literacy provider institutions" included in the study (Sivin-Kachala & Bialo, 1992, p. 21). In most adult literacy programs the use of the computer is supplemental. A primary curriculum in a content area, whether individually designed or program generated (e.g., GED), is assisted by instruction on the computer. Typically, the material is commercially available software utilizing an Apple IIE, IBM, IBM clone, or Macintosh. At least one printer is available to generate hard copies. Increasingly peripherals are attached to provide sound, scanning, or video capabilities.

A common configuration in a classroom or lab situation is to have the computers located in the back or at the side of the room, usually in a row. Often the location is an attempt to deal

with the noise generated since it is a distraction for other students. Used for drill and practice, writing activities, and games, such settings are frequently the first encounter adult literacy learners have with technology in the classroom. In some cases an authoring system may be purchased which allows the teacher to develop software for learners.

The least used application of technology, although often the most discussed, is that of technology as the *primary* means of instruction with a computer lab employing at least one ILS. Commercially available ILSs, as well as stand-alone computers and other technologies, are utilized. Even when technology is the primary means of instruction, there are teachers or tutors, books, paper, and pencils. In addition to the ILS as a technology delivery system, most vendors supply support materials in the form of videos, workbooks, worksheets, and/or tests. Technology has not been used as the sole delivery of instruction in adult literacy programs, except perhaps in an administrator's or vendor's mind.

Development of a total curricular system using technology requires a substantial financial investment. The advantage of an ILS is its offering as a *turnkey* operation—one that enables a literacy provider to purchase all services from one vendor and establish a fully operational lab at the outset—which may be ideal for a new program or site. Technology used as the primary means of instruction can provide a mechanism for managing and tracking instruction that was previously unavailable in adult literacy programs. The ability to provide individualized instruction while collecting aggregate data for reporting purposes is a major advantage. Experimental systems have been developed in the past (primarily on mainframe computers) by universities and the military; however, these have not been available to the general public. The systems that currently exist commercially are a combination of ILSs and curricular packages.

Many technology specialists believe that the use of ILSs is destined to be a passing phenomenon, making debate about the merits a relatively moot point. Rather than viewing the computer as the means of delivering an instructional program to teach reading, writing, or math, the use of application software to teach basic skills is advocated by many adult literacy specialists. Indeed, some argue that it is the *only* appropriate use of technology. Application software, such as word processing, databases, spreadsheets, and most recently, publications software

(or desktop publishing), is used in real life activities to develop reading, writing, and math skills.

Most literacy programs begin with keyboarding packages for learners and word processing as part of language experience activities, but few are using databases and spreadsheets for instructional activities (Sivin-Kachala & Bialo, p. 51). Using application software to teach basic skills requires staff who are knowledgeable about instructional design, able to develop templates and curricula, and have the time to do so. Knowledgeable staff are also needed for productivity software such as desktop publishing, which offers great promise for learners communicating with other learners in new and creative ways.

Telecommunication is the transmission of information by voice or computer signals across a telephone system (Que, 1992, p. 593). Telecommunication enables learners to access databases, form networks, and correspond electronically. As learners are viewed simply as adults needing access to mainstream information, technology becomes the vehicle for changing the way learning occurs. It becomes a tool for instruction rather than the instruction itself. At present most literacy programs with modems use them for instructors and administrators rather than for learners (Sivin-Kachala & Bialo, p. 29). Educators stress the need for real purposes for learners to use the systems and the difficulty of integrating on-line usage into the curriculum, a view supported by educational research in K-12 programs. Ultimately, the growth of multimedia, the use of telecommunication, and the downsizing of the computer, create a new image of what adult literacy instruction can be and many hope will be.

4. Assessment

Testing of learners is another area in which technology frequently makes a first appearance. Although the testing may be done manually, scoring is often done by a computer or scanning device attached to a computer. Centralized scoring of GED tests has advanced the possibility of data maintained and shared across time and space among programs. Systems such as CASAS, that have been adopted statewide, also provide models for systematic data collection through technology. At present learner outcomes and demographic data are maintained through separate reporting structures in virtually all literacy programs. Attempts to cross-reference data through special projects have been sporadic and underfunded. The current study by CASAS for

the U.S. Department of Education offers the promise of increased information on how assessment and evaluation are conducted in adult literacy programs and how data could be collected in a uniform manner.

PROGRAM APPLICATIONS

To gain an understanding of the specific applications of technology to the field, adult literacy is categorized into six basic program applications: (1) ABE/GED, (2) family literacy, (3) workforce literacy, (4) English as a Second Language, (5) corrections, and (6) libraries. Although all categories provide basic skills instruction, programs vary widely in their origin, funding, mission, and clients. As a result, their use of technology varies as well.

1. ABE/GED

ABE began in 1964 through the Economic Opportunity Act and is the largest deliverer of adult literacy services in the U.S. ABE provides services to adults at least 16 years of age and who are out of school and functioning below a high school completion level. Funding is federal, administered through the state, and often combined with local dollars or other sources of revenue. ABE is likely to serve GED clients as well in order to provide a full range of options for learners. The GED test has offered an alternative to the high school diploma in the U.S. and Canada since 1942. Preparation for the test is frequently offered as part of the ABE programs, although funding is separate and governed by a different set of regulations.

a. Major problems and needs

Separate funding has presented problems for technology acquisition because learners from both programs may share resources. Most local, state, and federal regulations that limited the purchase or lease of hardware have been removed, allowing resources to be purchased from either funding source and shared as appropriate. Federal and/or state regulations governing the use of funds in ABE/GED and other programs prevented literacy programs from purchasing technology. Although these rules have been changed in many states, program directors continue to believe the rules are in effect and use the law as a reason why technology is not in the program.

ABE programs are often conducted in school buildings in classrooms designed for elementary or high school students. Often the classrooms are borrowed from another program rather

than being dedicated to adult literacy operations. Such physical factors make the use of technology difficult. ABE teachers have been reluctant to use computers in their classrooms if they do not belong to ABE/GED. Some teachers have requested access to computer labs within the building and assistance from the technology specialists for the district. The use of technology purchased for K-12 or other educational programs continues to be a difficult issue for ABE/GED programs. Concerns for security, an unwillingness to share, and lack of clear policy on publicly funded resources, prevent adult literacy learners from accessing readily available technology.

The typical ABE/GED classroom has one or two computers located along the wall and used as support for curricular instruction (see Figure 1 in Appendix). Technology is viewed as supplemental and used as a resource when it fits into the curricular needs of the learner. Since most instruction is individualized within the classroom, the use of computers varies markedly from learner to learner and teacher to teacher. In addition, a VCR is often found and used frequently for GED instruction, often with the KET videotapes. Tapes and tape recorders are also used extensively in most ABE/GED classrooms.

A major problem for teachers in the typical ABE/GED classroom is finding and securing appropriate software. Finding software is aggravated by the fact that the technology used is aging rapidly. The typical classroom contains Apple II computers for which no new software is being designed. Most ILSs are beyond reach financially and logistically because of the temporary nature of the instruction.

When ABE/GED classrooms are combined with volunteer literacy programs or are part of a larger educational institution such as a public school, community college, or vocational institution, the picture is somewhat brighter. Often an enterprising teacher secures needed technology resources from another program and accesses them for adult literacy learners. Volunteers also bring their own resources to bear on the situation, sharing tape recorders, portable computers, and VCRs.

In a recent study conducted by the Office of Technology Assessment (OTA) in Washington, DC, the majority of adult literacy programs stated that they did not use technology because they did not have the funds to purchase it, not because they did not need it or want it. Thus, resistance to technology by teachers or tutors, ignorance of available sources, or complexity

of the decision-making process are *not* the principal reasons why technology is absent in adult literacy instruction. Rather, it is a lack of money. Impoverishment continues to be the principal reason why technology is not found more frequently in the ABE/GED classroom, in spite of years of testimony and research into the value of technology for adult literacy instruction and a recent federal report that stated, "Technology...must be part of any quality literacy movement in this country" (Chisman, 1989, p. iv).

b. Implications for technology use

Funding for technology is not the only difficult issue confronting ABE/GED programs seeking to use technology effectively for adult literacy instruction. Securing accurate and timely information is an ongoing battle for teachers and administrators. Literacy programs continue to find and seek solutions independently, often reinventing the proverbial wheel. One of the main findings in a recent OTA report was that programs stated that "word of mouth" was the principal means of securing information for software selection, an indication that there are few vehicles for sharing information on technology or any other matter.

One way accessing information is being addressed is through linking literacy programs electronically in California, New York, and Canada. In California, the OTAN system offers literacy providers access to a large database that contains information on grants available, curriculum, and software reviews. In New York, Apple Access links literacy providers affiliated with LVA.

Technology provides good and bad news for adult literacy programs confronting the growing pressure for accountability. The bad news is that programs often purchase an ILS specifically because of vendor promises that it will provide the data needed to justify a program's existence. Both funder and provider become frustrated when claims cannot be fulfilled. The good news is that technology promises the means to satisfy the current conflict between authentic student assessment and program accountability. The computer's ability to handle massive data quickly, format information for a variety of uses, and store it over time, provides a partial solution to the debate. However, technology's capability must be thought through systematically and applied meaningfully to the issue of assessment and accountability.

2. Family Literacy Programs

Family literacy is still the new kid on the block for most adult literacy providers. Although definitions and program design differ, family literacy programs share a common belief that literacy issues must be addressed through the unit of the family, not the child or adult. They believe that breaking the cycle of illiteracy can only be done through an intergenerational approach, in which children and adults are taught simultaneously. Through the establishment of the National Center for Family Literacy in Louisville, Kentucky, and the work of Ruth Nickse, Ruth Colvin, Nancye Gaj, Sharon Darling, and others, family literacy is evolving into a specialized field.

Most programs involve three separate strands: instruction for the child, instruction for the adult, and instruction for the parent and child together. Technology can be used to support the instruction for any or all of these strands. The use of technology varies markedly from one family literacy program to the next; however, many use technology for some portion of the instruction.

a. Major problems and needs

In some family literacy programs an ILS may be used when the parent and child work together at the keyboard. ILSs with multiple languages are particularly useful in a cooperative arrangement by attaching several headphones to the computer. Other common uses are for parent and child to work together to create a story, greeting cards, or banners; to design a product that will benefit another family member; or to use genealogy programs to trace family roots and transmit stories from parents to children.

Video and audiotapes are used effectively in family literacy programs to support parents who wish to read to their children. *The Reading Rainbow* television series and Walt Disney tapes are used to teach parents so they can teach their children. Parents can hear and see the story to enhance their understanding of the plot. Small group instruction provides support for parents on how to read to their child as well as the words they will need to know. Parents can use portable, take-home computers with their children as part of a language development process.

In research conducted by the National Center for Family Literacy, electronic bulletin boards were used to facilitate parent-parent, child-child, and teacher-teacher communication. Although results are still preliminary, the study found that

teachers and parents became increasingly frequent users of the system, sharing curricular issues, parenting needs, and recommendations for conducting successful family literacy activities with each other.

b. Implications for technology use

Currently, software is not designed specifically for family literacy programs and must always be repurposed for the activity. When word processing is used, design is not a particularly great problem. However, the software is asked to perform beyond its instructional design when the outcome is achievement for parent and/or child. In the case of an ILS, not only the instructional system but also the management component are asked to perform double duty.

Two related but larger problems are a significant lack of clarity on what exactly a successful family literacy program should accomplish and the cost of operating a family literacy program. When program goals are unclear, technology becomes the scapegoat for deeper frustrations in program design. Frequently started with soft money, the ability to maintain a program over time is a major issue in the literacy field. Technology purchased for a family literacy program may sit idle or not be easily absorbed when the family literacy project ends; long-term funding for such efforts is a major issue.

3. Workforce Literacy Programs

Workforce literacy programs have had a longer history but under many other labels. The workforce literacy label has provided some cohesion for employers and providers and the concomitant development of a field. Workplace or workforce literacy refers to basic skills instruction that is conducted for those currently employed, seeking employment, or changing employment. It is usually but not always conducted at a worksite. Major workforce literacy programs are also offered in union halls and as part of an existing ABE or community college program. Vocational schools have long offered basic skills instruction as part of their preparation for the job market.

a. Major problems and needs

Workforce literacy programs are funded through a variety of public and private institutions, many exclusively by employers seeking to improve the skills of their employees; others represent public/private partnerships. Although the goals of a workforce

literacy program may include the GED or high school diploma, the primary focus is employment.

Unlike educators who are resistant to technology as a primary means of instruction, employers frequently seek a technological solution first. A difficult situation is created when literacy providers are asked to use technology that they did not want in the first place. ILSs and curricular systems are frequently found in workforce literacy programs because they provide flexible scheduling and seem to solve a problem quickly.

Far more difficult and desperately needed are technological solutions that are grounded in the functional context philosophy of most workforce literacy programs (Park, 1987). Functional context literacy supports the notion that for basic skills instruction to be meaningful and lasting, it must be delivered within a specific context, such as a particular job (Sticht, 1988). Thus a baker learns baking terms, not a generic list from a workbook, as part of the reading instruction. Such a logical proposition experiences difficulty in universal adoption by adult literacy programs partly because implementation is more difficult than it appears. Curricula are usually developed as a result of the needs of a significant number of people (whether children or adults). For example, most people believe that children need to learn the multiplication tables; therefore, book publishers invest millions of dollars developing curricula to teach multiplication.

In an ABE classroom there are rarely two people with identical needs for instruction that would warrant development of a full curriculum. Bits and pieces from various sources are brought together by the teacher to develop an individualized curriculum which, however, does not fulfill the requirements of a functional context curriculum. In the workplace the situation is much easier because a large number of people may be doing the same job. A curriculum can be developed to teach the skills required specific to the need. Technology in the form of video, computer software, and tapes is ideal to provide the type of functional context instruction required in the workplace.

b. Implications for technology use

Unfortunately, the application of technology to workforce literacy rarely occurs in some cases because there is not enough expertise in the dual worlds of literacy and training to develop a functional context curriculum employing the latest technology. In other cases the limitation is in the technology itself since software development may lag behind instructional demands.

Few employers are willing to pay for extensive software development specific to a company's instructional needs. Aside from cost, the amount of time required is often prohibitive. Authoring tools increasingly are used to develop practice exercises for learners with specific job needs. Packages with authoring capability, designed specifically for the workplace, are on the horizon but not yet available.

Although funding is less an issue in workforce literacy programs, sustained support for existing programs is a major problem. The demand for quick solutions has created numerous workforce literacy projects with a lifespan of one year or less, frustrating employers and literacy providers and creating a backlash to technologies that do not deliver what could not be realistically expected in the first place. Matching meaningful and permanent technology solutions to specific literacy needs in the workplace is a major problem for workforce literacy providers.

4. English as a Second Language (ESL) and Other Language Programs

Some of the most interesting and creative uses of technology are found in ESL programs. The programs may be part of a larger ABE/GED project or exist independently as part of a community-based organization. Frequently the creativity is a result of necessity because software does not exist to meet the diverse language and literacy needs of learners.

a. Major problems and needs

The use of technology is not new but is a readily accepted part of English language training when oral language and sound are central to the instructional process. The use of tapes, language masters, learning labs, radio, and television have long been part of the ESL tradition. Newer applications are a result of the development of quality sound systems for the computer with authoring capability. Teachers and tutors use sound to teach correct pronunciation so learners can hear their voices in comparison with a standard that is either part of a software package or authored by the teacher. Authoring packages provide programs with the flexibility needed to create instructional exercises in languages specifically for English learners.

Although there are different philosophical approaches to how English should be taught, there is significant growing interest in teaching literacy skills first in the language of origin (Knoblauch, 1990). Technology can provide needed support for language

experience stories for learners working in their native language. In some classrooms learners work together to generate a story in the native language that is printed, copied, and read by the class. The story is then translated to English as part of a group experience. Closed-captioned television has been used for some time by immigrants to learn the English language in a limited way but holds great promise for the future when all televisions will have closed-captioned capability.

b. Implications for technology use

Technology has not kept pace with the diversity of our nation. Software vendors insist that there is not enough memory to accommodate the need for multiple language instruction despite repeated demands from literacy providers. When multiple languages are available, the selection of language is made by the teacher or administrator at the time of purchase or when the learner is assigned instruction. Unlike the Electronic Banking System (EBS)—which places control in the hands of the user by asking at the beginning of a transaction, "What language would you like?"—literacy software lags far behind.

Community-based programs often lack the technical sophistication to know what technology can do to support their efforts, but have a clear understanding of the language and social needs of their constituents. Software programs designed for specific populations are beginning to appear on the market. Unfortunately, most of these are simply translations from English rather than programs developed for specific learner needs. It is hoped that the situation will improve as vendors begin to research the market for their products within specific populations and community-based providers become more articulate about their technology needs.

5. Correctional Programs

The first major law requiring education in correctional facilities was the Federal Prison Act of 1935, which mandated vocational training. Correctional programs began using computers experimentally in the 1970s. Their use and influence expanded following the changes in technology from on-line to free standing units to ILSs. Some of the oldest technology for basic skills instruction is still in operation in correctional facilities in the U.S.

a. Major problems and needs

Prisons and jails present unique challenges for the use of technology because security is the primary concern at all times. The use of floppy discs is prohibited in many correctional facilities because the corners can be used as weapons. Telecommunication is prohibited in others because of prior experience with prisoners accessing unauthorized databases, making phone calls, and conducting illegal operations.

The advent of cable television and video—the TV is on 24 hours a day—has also created new options for instruction. Interactive television enables prisoners to take college courses for credit and participate in classroom instruction in innovative ways. One study found that women in a detention center who were part of a community college interactive television course chose to attend the college after release, despite its inconvenient location for many of them (Knutson, 1992). Correctional officers view the use of technology as a way of confronting recidivism. Prisoners become part of the community prior to release through interactive television and electronic networking.

b. Implications for technology use

The recent inclusion of mandatory literacy in state laws and sentencing guidelines has an impact on technology selection. As more prisoners are sentenced to literacy programs, technology increasingly is viewed as a necessity in the correctional facility. The link between technology and lowered recidivism is beginning to be researched (See Langenbach in Fleischman, 1990), giving new support for technological applications in correctional facilities. Similar to workforce literacy, the concern among professionals in correctional education is that too much will be expected too soon. Because technology is not developed specifically for correctional programs, educators must evaluate and adapt software and hardware for specific prison and prisoner needs.

Another problem is the lack of consistency across correctional institutions. Not only are prisoners isolated, but staff are as well. Philosophical differences between different prisons and jails result in differing views of literacy in the correctional setting. It is not uncommon to find a lack of consistency in assessment, curriculum, staffing, and technology from one correctional facility to another. Prisoners are frequently transferred between institutions and suffer from a lack of consistent educational programming.

6. Library Literacy Programs

Historically, the role of libraries and librarians was to provide books for people. This fairly straightforward function was neither easy nor obvious at the time of the first public library created by Benjamin Franklin. Making books available continues to be the primary goal for public libraries, but the situation has changed and libraries have taken on a larger worldview of providing *access to information*. With the change that began in the 1960s (Cook, 1977, p. 88), librarians came to view libraries as an integral part of the community and literacy as an issue for which they were responsible.

a. Major problems and needs

The new community responsibility of libraries has taken several forms, such as providing space for tutors, purchasing low-level readers, and developing literacy programs. The use of technology in literacy instruction made an early appearance in library efforts. The Technology Transfer Project in the early 1980s at the Pratt Library in Baltimore and the Weir Library in Weirton, West Virginia, used materials designed by the U.S. Navy for basic literacy instruction with tutors and beginning learners. These efforts were followed by the much larger California Literacy Campaign in 1983, with a $2.5 million initial commitment to literacy instruction in libraries. Between 1983 and 1985, California's libraries became involved in cooperative literacy projects with existing literacy agencies, creating many new models for literacy instruction and partnerships. Many of these projects requested technology as part of their grant applications.

Likewise, the Library Services and Construction Act (LSCA) in 1990 appropriated $2 million for library literacy services. The LSCA grants have been awarded through a grant process that requires cooperation between libraries and existing literacy providers. Many of the projects have also requested technology as a portion of their delivery system and have found that technology is a major attraction for learners to attend programs (Main & Whitaker, 1991, p. 14).

Libraries provide unique opportunities in literacy instruction with their long hours and community orientation. Furniture is designed for adults and the buildings are not schools. Technology works well in such an environment where librarians, long accustomed to the use of computers for cataloguing and

communicating, have an easier time understanding its potential than do many teachers or tutors.

Perhaps the most significant contribution of the library to the literacy field is a new way of thinking about literacy. As librarians have rethought their role in the information age, they have broadened the thinking of literacy professionals as well. Access to information through a wide range of modalities, one of which is the book, is a major library theme. Literacy professionals, bound by the constraints of print literacy, are beginning to envision a world in which the teaching of literacy skills encompasses all of the senses.

b. Implications for technology use

Librarians—believing that their job is not to teach but to provide service—have become frustrated with the demands placed upon them by the literacy community. Too often grants are used to purchase materials, such as tapes (audio and video), software, and books, that remain on the shelves unused. Lack of expertise in the literacy field has resulted in inappropriate purchases and support for library literacy programs.

Examples of exemplary programs abound across the U.S., but ongoing support is a major issue. Many quality library literacy programs folded once the funding ended. Competition between librarians and literacy providers for scarce resources is a growing concern. As computers sit idle in a room dedicated to literacy instruction, library patrons request technology for their needs.

ISSUES IN THE USE OF TECHNOLOGY

Staying abreast of current technology developments is a major issue for anyone interested in the field. The power of computer technology now doubles every 18 to 24 months; therefore, a desktop computer today can do more than a typical million-dollar machine could do a decade ago (Kurzweil, 1990, pp. 8, 218). As technology expands, so does the need to know about the new technologies. For literacy providers the problem is exacerbated by the fact that there is little information about the application of technology to adult literacy.

Aside from the specialized area of technology, there is little information about adult literacy in general. The lack of systematic assessment and evaluation in literacy programs is a repeated theme in literacy literature (Beder, 1991; Sticht, 1988). The lack of development of adult literacy as a separate field in education, with its own theories, research base, and accepted standards, compounds the difficulty of applying technology.

1. SELECTION

Decision-makers have difficulty securing purchasing information. The amount of time, effort, and energy required to select software and hardware for an adult literacy program causes many teachers and administrators to give up entirely. The lack of an adequate process results in costly and inappropriate selections. Poor choices often result in backlash that delays further involvement in technology for years. Teachers say, "We tried it; it didn't work." Technology is blamed rather than assessing the failure as part of larger program issues.

Ten years ago a frequently heard comment was, "There isn't any good software out there." Now a more common concern is, "There is so much to pick from, where do I start?" Software reviews in educational journals ignore the adult literacy learner as a potential user. Likewise, sales representatives often approach adult literacy professionals with only information designed for K-12. Materials that receive rave reviews in a second grade classroom may be totally inappropriate with a new reader. Ducks,

rabbits, and happy-faced clowns are not acceptable reinforcers for adult learners.

Conversely, adult literacy teachers find materials designed for K-12 that work well with adults, although the publisher may be unaware of the potential market. Such cases are problematic when materials are offered in catalogues specific to grade-level rather than population. Some vendors insist on selling only their adult products to the adult market and refuse to bring lower level software for display to adult education conferences or provide demo discs to programs.

Despite a growing body of information, recent studies conducted for the OTA indicate that adult literacy programs continue to select hardware and software principally by *word of mouth*. Although many software lists specific to adult learners were developed in the 1980s (e.g., Adult Literacy and Technology, 1988, 1989; Technology for Literacy Center, 1985; Literacy Assistance Center, 1988; Region 10 Software Buyers Guide, 1985), most of them are out of print. Even when a copy can be found, much of the information is obsolete and lacks the necessary updates of new technological developments.

The good news is that vendors are assuming some responsibility for distributing information. Apple Computer has developed two guides, one for adult literacy and one for ESL. IBM has also distributed information on software programs that run on its network and stand-alone systems. Adult literacy catalogues designed to advertise print materials regularly feature software, and a few have developed their own software catalogues. As technology becomes increasingly common in literacy programs, software and hardware are exhibited at literacy conferences. The volunteer literacy groups, LVA and LLI, as well as the Commission on Adult Basic Education, Association for Supervision, Training, and Development, and the International Reading Association have had computer labs and vendors featuring adult literacy software at their conferences.

Technology should be viewed as a way to solve problems, not create them. An adult literacy program that already has a clearly defined and effective process for selecting instructional materials, such as textbooks, should have little difficulty making the transition to purchasing technology.

Unfortunately many programs do not involve teachers, learners, or volunteers in the selection of materials, or do so in an arbitrary and capricious fashion. In short, where there is little

consensus on program curriculum and goals, technology simply exacerbates underlying problems. In many cases technology is blamed for issues that are really endemic to the adult literacy arena. Issues such as who are we trying to serve, what does success look like, and how should we teach reading anyway, surface when trying to select hardware and software.

Technology selection should be based on a previously identified need or problem within the program. Instructional software should be selected for its ability to address a gap in the curriculum. A careful consideration of resources available to make the purchase should be developed, including funding, expertise, space, technical support, and time constraints. The following questions can serve as a guide for any adult literacy program trying to make purchasing decisions, particularly when the purchase is a major one, such as an ILS. These questions need to be addressed and documented to establish clear goals at the outset prior to contacting a vendor.

- ***Who is the target population?***

  Although the program may serve a wide variety of learners, not all software works equally well with every population. Like textbooks, materials need to be selected with specific learners in mind. For example, ESL, low-level readers, or GED may be identified as the target population. Since the target population may be one that the program has not served as well as desired in the past, the technology becomes a recruiting tool. Software can be targeted to a new project or specific funding, such as workplace or family literacy. Although a vendor is likely to suggest that the software will serve *all* the learners in the program, limiting the focus increases the likelihood of satisfaction with the product.

- ***What is the purpose of the purchase?***

  Thinking through the desired outcome also enhances satisfaction with any purchasing decision. What will happen as a result of the purchase from a programmatic perspective? For a large purchase, such as an ILS, the outcome may best be framed as a one year goal. If the program works for the target population, in one year there will be increased enrollment, higher test scores, greater overall performance, *or* a more integrated curriculum. Note that all the goals may be desired or worthy, but one purchase cannot be expected to achieve everything. Again, despite vendor promises, the clarity of

outcomes desired by administrators, teachers, and tutors assures a wise purchasing decision.

- ***What are the long term goals for program development?***

Is the purchase a one-time investment or part of a long-term technology expansion? The answer to this question is likely to depend on the funding source for any purchase. Often a technology purchase is the result of a one-time grant from a limited funding source. Program directors desire to maximize the long-term benefit of a one-time purchase. The situation is different if funding is part of the ongoing operation that may be expected to increase, albeit through small increments, over time. Funding needs to be considered not only in terms of sustainability over time, but also in terms of differentiation between equipment and software. Many states have laws prohibiting the purchase of equipment in certain programs, or have stringent guidelines. More than one literacy program has had the resources without the legal permission to purchase hardware. Understanding options in terms of purchase, leasing, and lease-purchase is important for literacy providers. Frequently technology purchases involve contracts with implied obligations for both vendor and the literacy program.

Although it is difficult to generalize, leasing is often a better program option because of the built-in obsolescence of technology. At the end of a three-year software lease, a literacy program may find another system that teachers like better or wish to upgrade. In any event, discussion with other literacy providers using the technology should include recommendations on payment and contract negotiation.

- ***How does the technology purchased fit into the curriculum design?***

Is there a curriculum in place to which the technology will be added? Or will the present instruction be subsumed under the technology curriculum? Who will provide the integration and curriculum design? Integrating new technology into an existing program is the more likely scenario for an established adult literacy program. Conversely, subsuming or providing support curricular materials to the purchase of a major ILS system is more likely to

occur in a new literacy program, often with a clearly targeted population.

Either scenario brings unique challenges. Integrating technology into the curriculum is the subject of numerous books and articles. In adult literacy the issues are similar to K-12, but not identical. Often a formal curriculum does not exist in adult literacy programs and technology presents the first opportunity to provide standardization. Depending upon the teacher and philosophy espoused by a literacy program, such standardization may or may not be a good thing. Regardless of the value placed on standardized curriculum, the introduction of an integrated learning system will force the issue.

For many literacy providers the inclusion of authoring capability has provided the desired flexibility required for individualized instruction. The degree to which the curriculum presented can be reformatted by the learner as well as the teacher is a major question to ask vendors. However, not all teachers are equally comfortable with programming the computer. Integrating technology into the curriculum requires consensus among literacy providers within a program on what exactly the curriculum should be.

- ***What training will be needed?***

An administrator needs to address whether the people who will be using the technology are already knowledgeable in the area of computers. Is the desire to receive training a major reason for the purchase? Most major ILS vendors offer three days of training as part of the sale. Such training may be far more than a literacy program needs if it has been using ILSs for years. Conversely the training may be woefully inadequate if the purchase is a first technology attempt for a literacy program. When there is little need for training, a program can pay thousands of dollars for unwanted services that are written into a contract. When the training needs are great, a system for ongoing support is often better than a crash course on program operation by the vendor.

Another factor is the quality of the trainer or trainers. Most vendors are eager to provide excellent

training and support for their product. It is in their best interest that the customers know and like what they have purchased. Again, clarity of program needs at the outset facilitate a satisfactory training process in the new technology. In some cases literacy programs find that the *best* reason for purchasing technology is the staff development received by the teachers. Often trainers have a strong educational background coupled with wide experience. They may resolve a myriad of staffing and curriculum issues as part of the training simply by providing information not previously available to a literacy program.

- ***Where will the system be located?***

Too often technology is purchased without determining its location at the outset. Correct location affects the ultimate operation and success of the purchase as much as any other single factor. Increasingly technology encompasses sound as a major component, necessitating headsets and consideration of noise issues. Likewise, printers and keyboards distract learners who are reading or otherwise engaged in a quiet pursuit.

Special wiring may be required for any room not previously housing an ILS system. The cost of wiring, including labor charges, should be factored into the purchase. Supporters may change their views when they become aware that rooms must be remodeled to accommodate technology. The highly transient nature of literacy programs makes location a serious consideration. Literacy programs relocate frequently to accommodate other educational programs having a higher priority. Often they occupy temporary space. If relocation is an issue, moving costs, as well as licensing issues, should be negotiated with the vendor at the time of purchase. Frequently a vendor will agree to assist with the move and provide accommodations for the licensing arrangement. Without the preliminary installation discussion, the literacy provider and the vendor can find themselves at odds.

Security must be considered as well. Some literacy programs are located in high-risk areas where crime is a concern, and security of equipment must be addressed as part of the decision-making process. Several effective strategies involve placing computers in rooms that are not readily visible to the street or general public. Anchoring

computers to rolling carts allows flexibility of use while discouraging removal.

Remodeling and security considerations should be completed before the computers arrive. A master switch that controls all the electricity in a room is a functional addition that can save time-consuming computer checks and overloaded circuits. A room filled with computers can generate tremendous heat and is also a consideration as part of the remodeling necessary. Having the computer room on a separate thermostat is recommended.

Although many of the manuals designed to assist in designing computer labs for the K-12 classroom can be useful for adult literacy programs, there are some significant differences. First, issues of control and discipline are rarely found in adult literacy classrooms. Many of the ILSs are designed to assure teacher control of the learning process. Such systems also assume group instruction and standardized curriculum rarely found in adult literacy programs. Control factors may or may not be problematic depending upon the philosophy of the adult literacy program and the ability to override commands within the software systems. Lab design affects location as well in that technology designed for a K-12 classroom may not work as well in a community center, library, or work site.

- ***What type of ongoing service needs will there be?***

Who repairs computers? Is there a maintenance agreement for the hardware being purchased? Too often maintenance agreements are signed by literacy providers unaware that they could have had access to repairs as part of their local school district or community college. Computers are no longer the fragile creatures that require dust covers and air conditioned rooms to survive. Increasingly, the challenge is to determine how to employ obsolete technology that continues to perform well mechanically.

A general guide for decision-making on repair contracts is to consider the age of the platform purchased. If the technology is new and flashy with the latest bells and whistles, it is also more likely to have technology glitches that will be more difficult to identify and repair by local companies. If, however, the computer being purchased has been on the market for three to five years, any major bugs

in the system should have been eliminated. Repair work is more likely to be standardized and available locally.

The cost of ongoing maintenance needs to be factored into the technology purchase. Too often a literacy program has funds for the initial purchase but not for operating maintenance, resulting in computers that sit idle surrounded by frustrated instructors and learners.

- ***What type of evaluation or accountability is required?***

  Adult literacy programs are increasingly being asked to justify their program operations and demonstrate successful results. The purchase of technology is often the result of such a demand. Computers collect and organize massive amounts of data in ways that were previously impossible to accomplish. Literacy programs with thousands of learners now can maintain individual records over time that previously would have been lost in filing cabinets. The same records can be collapsed to provide aggregate demographic data on types of learners served, prior educational attainment, and ethnicity.

  Individual student information can be combined with test scores to provide profiles of learners, to list services provided, and to identify gaps in program operation. The use of portfolios and authentic assessment also necessitates rethinking ways of collecting and presenting information. Computers can provide a means for literacy providers to compare the performance of learners over time, at different sites, and in different programs. When purchasing ILSs or other forms of technology, the ability to provide meaningful assessment and evaluation data is increasingly the single most important factor in the purchasing decision.

Thinking through the type of assessment and evaluation that is required to demonstrate successful program operation as a result of a technology purchase links back to a clear description of purchasing goals. Several additional recommendations assure satisfaction on the part of the literacy provider:

- ***Use the sales representative to help answer questions.***

  Many sales representatives were teachers first and continue to be vitally concerned about providing quality instruction. It is unlikely sales representatives will try to sell a product in which they do not believe or provide inaccurate information. It is in their best

interest to match the right product with the right customer. They can take the guesswork out of the technology selection process by providing timely information. Unfortunately, too many literacy providers have not done their homework prior to contacting a vendor (or before being contacted.) If a literacy provider answers or attempts to answer the above questions prior to engaging in dialogue with a vendor, the process should go quickly and smoothly.

- ***Contact and/or visit sites where the system is installed.***

  Unless the product has just been released on the market with no installed base, the buyer needs to talk with other users. Most sales representatives are eager to supply a potential customer with the names and phone numbers of satisfied customers. A company that is unwilling to provide this information should be held suspect. Vendors find it more difficult to identify similar programs for comparison; yet, ideally, a correctional facility should talk with staff at another correctional facility using the product. At this point several phone calls around the country are well worth the expense to identify like programs that are using the product. Occasionally a vendor will offer to fly serious prospective buyers to view an installed site. Such an exchange is an excellent opportunity to gain first-hand experience. However, as in other business negotiations, it is helpful to remember that there is no such thing as a free lunch.

- ***Never purchase on the basis of a demo alone.***

  Demonstration hardware and software cannot provide the in-depth information needed for a major purchasing decision. Unfortunately, the product to be purchased, whether hardware or software, is often in development. When the contract is signed, what is purchased is known as *vaporware*, which may or may not materialize. Most vendors are willing to negotiate such issues, often including a six-week trial period to assure total satisfaction with the product. The agreement protects the vendor as well as the literacy provider, assuring that closure can be reached on the transaction.

Finally, and most importantly, is the Greek admonition, "Know thyself." Literacy providers who are clear about their needs as well as their goals for the program are in the best position to make good technology decisions. The process of technology selection can be anxiety ridden, due to the belief that a specialized body of knowledge is required and that the process is somewhat esoteric and doomed from the outset. It is helpful to know that the most experienced technology users can resort to rolling dice to make a final determination based on the fact that technology changes rapidly, no one can be certain of having all the information, and risk is inherent in the process.

One useful typology developed to assist literacy programs in the selection process begins with context, identifies software to consider, and gives specific examples (see Table 2 in Appendix). The typology begins with the situation and then suggests instructional options that are found in a variety of software types. From these types, specific program names are identified. The caution is made again that six months is viewed as an outside limit for all technology recommendations. In the example given, however, most programs have been available for several years.

2. Assessment and Evaluation

Some of the technology research conducted in K-12 classrooms has informed the area of adult literacy. Likewise, valuable resources such as MECC, Educational Products Information Exchange (EPIE), and software guides developed for children have been used to benefit decision-making in adult literacy programs. Journals, books, and studies, such as *Power On!*, have also had an impact on adult literacy instruction.

Focused research on the use of technology in adult literacy programs is so limited that it is almost non-existent.

The lack of adequate research has not stopped vendors from extrapolating findings from studies of children to adults, mainframes to micros, or control groups to the general population. Neither has the lack of information stopped practitioners from purchasing and using a variety of technologies in adult literacy programs. The descriptive data that has been collected from adult literacy programs nationally and internationally reflects a shared appreciation for the worth of technology in adult literacy instruction.

In addition, technology does not lower the educational cost of a program. Although often used as the justification for a major technology purchase, studies have shown that cost does not come down when technology is used (Johnson, in press).

Evaluation of adult literacy software has been sporadic, depending upon soft money and varied methodological approach. Some of the best analyses were those conducted by the Region X Consortium in the early 1980s. Funded with Federal 310 money, the process networked adult literacy teachers from several states to review software independently and collectively (establishing inter-observer reliability). The review was followed by piloting the software with learners at the respective sites, and the results were published in the Region X software guide. Other methods of review have included the use of an expert to review software according to predetermined criteria. This results in a consistent and thorough analysis, but is limited by the bias of the particular reviewer. The greatest problem, however, is a lack of funding to update reviews. As a result, many software guides are no longer available.

Adult literacy programs often provide their individual lists of software to other providers, and such lists are frequently the most valuable information available. Over time large programs with abundant software reviews have developed more rigorous screening criteria to enable new programs to identify software worth reviewing quickly, particularly when the same software package appears on several programs' lists.

Commercial vendors have begun developing software guides, the most notable being the *Apple Access Guides* for adult literacy and ESL. The majority of vendor guides lack information specific to the populations served by adult literacy programs. As a result, traditional computing magazines are rarely used by adult literacy

programs to assist in a purchasing decision. Reviews of educational materials focus almost exclusively on K-12, a frustration for teachers and administrators.

The use of technology in adult literacy programs has grown so rapidly that research and literature usually associated with the development of a new educational specialty have not appeared. Research on technology cannot be considered apart from the larger issue of the paucity of research in adult literacy in general. An often cited study by Darkenwald (1986) identified 236 journal articles on adult literacy but stated that less than a dozen qualified as genuine research. Sticht (1988) concluded that, "The history of adult literacy education reveals a 'crisis mentality' toward literacy education of adults that has hindered the development of a cadre of professionals trained in adult literacy education and a body of research-based knowledge about the development of literacy in adulthood." Most recently, Beder (1991, p. vii) describes adult literacy research as, "fragmentary and even contradictory."

Apart from the difficulties of conducting research in adult literacy, technology research has suffered from limitations as well. Early studies of computer-assisted education (CAE) and computer-based instruction (CBI) measured gains of learners through controlled studies following experimental design models. Most of the studies conducted were on children and the technology was mainframe computers. Studies conducted on adults were from populations who were incarcerated or in the military (truly *controlled* groups!). Other studies which projected cost comparisons of traditional instruction versus computerized instruction have been found to be woefully inadequate, as indicated by Patton (1987), who decried "the paucity of systematic evaluation data for literacy programs in general and technology-based literacy programs in particular."

FUTURE PROSPECTS

At a recent literacy conference an adult literacy teacher described herself and her staff as "burned out on technology." When asked what she meant, she said: "We've done it all. We've previewed and ordered, and we don't even do that any more. There's just nothing new out there." At a focus group conducted to plan a new literacy center, volunteers were asked what they wanted in the new facility. The number one item on the agenda was technology *that works*.

This sentiment is echoed by another practitioner describing the use of computers in her program:

> In the past year very few commercial programs have met the approval of our instructors. After a few years of working with computers, instructors have developed standards and expectations for what computers can do...we continue to search for software [that will] encourage adults to be self-directed in their learning and [will] treat subject matter holistically (Bredemus, 90, p.32).

In some cases technology has not kept pace with changes in adult literacy; in others, adult literacy has not kept pace with technology. For example, a recently released software package literally put a workbook on the screen despite the fact that this has been viewed as unsound instructional design for years. It seems we are at a plateau where the fields of both technology and adult literacy are being questioned, challenged, and re-envisioned.

The promise of technology is waiting to be fulfilled. Many of the current debates and issues (see Beder, 1991) in the field of adult literacy may find their resolution in technology. Problems such as how to serve more people, how programs can be accountable for their services, and how adult literacy education should be provided are debated topics that may find solution or partial resolution through technology.

1. How to Serve More People

It is estimated that all the literacy programs combined are currently serving only 4-6% of the total potential population (Hunter & Harmon, 1985). These figures have caused many to question the efficacy of the present delivery system, which is publicly funded and institutionally based (See Fingeret, 1991; Beder, 1991). Minority communities and community-based organizations strongly criticize a structure for delivery of adult literacy as one that perpetuates the dominant culture. The current model relies heavily on the institutional experience with classrooms, teachers, and tests.

The desire to serve more people has found a warm reception among technology devotees, with mixed results. The drive to increase numbers has led to adoption of technologies that were billed as *teacher proof*, requiring little more than an assistant to flip the power switch. Educators decried such a challenge to their authority as unsound educational practice. Indeed, they have successfully fought this battle in one educational arena after another (corrections, elementary schools, and colleges, for example). A computer cannot be held accountable for grade level improvement; for that, a human being is needed.

As the world shrinks through satellite networks, fiber optics, and electronic banking systems, new ways to communicate and deliver instruction are being widely discussed. It has been suggested that the newest computer hardware and software might be effective in reaching 93-97% of those not found in traditional educational settings (Reder, 1992). The advent of interactive television has created multi-link delivery systems that challenge the stereotype of educational television as a *talking head*. The image of basic skills instruction available 24 hours a day, through a variety of modalities (television, computer, telephone links) has long been a dream of adult literacy technology educators.

At a recent workshop on adult literacy and technology, the consensus was that the adult education learner should be treated more like a consumer and less like a classroom student (Kruidenier, in press). The paradigm shift required to accomplish this must occur in adult literacy, not in technology. Those who are moving away from the traditional classroom model to one that is learner-centered and learner-driven have less trouble with this concept. New technologies have always challenged the existing power structures and their need for control. It is not surprising, therefore, that this is also a major part of the resistance to technology in the adult literacy field.

Resistance from administrators, teachers, and tutors far exceeds doubts of learners. Learners view technology for what it is: a hope for finding a new way to address old problems.

2. How Assessment and Evaluation Can Be Meaningful

The demand for accountability in adult literacy programs is a theme in many public agencies, such as state and federal departments of education and labor. Likewise, the private sector is increasingly reluctant to put dollars into adult literacy programs where the number of learners grows and outcomes cannot be substantiated.

This is in sharp contrast to the demand of literacy providers for authentic assessment, where measures of progress are based on learner experience rather than standardized tests. The growing use of portfolios, writing and reading samples, and development of learner outcomes is frequently pitted directly against the demand for accountability. How can programs be held accountable for results when each learner has an individualized learning plan specific to his or her needs?

This apparent dichotomy finds its resolution in technology. The ability to collect aggregate data in the form required for authentic assessment is virtually impossible to do manually in a large literacy program. In an urban area which serves thousands of learners a year, each learner would maintain a separate file folder containing an individualized plan and records. The stories, anecdotes, and criterion-referenced tests would be maintained through files in filing cabinets for individual learners and individually reviewed and assessed to provide information for learner progress and program development.

Collecting this information across files in a format that could be used for reporting purposes is virtually impossible at present. In the future, however, it is easy to envision a system that utilizes scanning of documents into the computer, collects salient indicators, and is capable of reporting the information in multiple formats. For example, one indicator might be: parent reads story to child for the first time. This information could be collected across programs and over time. Development of the indicators must come from the learners and programs themselves as they identify and define what authentic assessment means. An alternative to standardized tests and burgeoning filing cabinets is possible through the use of technology.

3. How to Provide Literacy Services

A great deal has been said about the information age and technology in the information age. Less has been thought about literacy's role in relation to the information age and technology. For some futurists, our present concern for literacy is misplaced energy. The obsession with print literacy has been described by Richard Latham and others as a temporary phenomenon, soon to be displaced by the larger issue of needed expertise in multiple literacies, namely visual, audio, and kinesthetic. In this view, print literacy is a small blip on the evolutionary path of human communication that begins with cave drawings, moves through the printing press, the computer, and envisions a future where visual literacy for symbolic meaning is at least as important as language itself.

Twenty years ago this sentiment was expressed in *The School Book*:

> The stewards of our schools are people for whom reading and writing have been their most important means of expressing intellectual interest and competence...the difference, of course, is that the students have no power to assign their teacher to remedial film-viewing classes....As youth becomes more oriented toward electronic media and away from print, the reading problem will become more acute. By equating intellectual competence with reading ability, we condemn by definition perhaps half a generation to failure (Postman & Weingartner, 1973, p. 89).

Power figures prominently as a key concept in the literacy field. "Literacy has always been connected to power, and the development of literacy skills by new groups threatens the present distribution of power," according to Fingeret (1991, p. 8).

The concept that ***knowledge is power*** is central to understanding the instructional needs projected for the information age. The decentralization and redistribution of power through technology is a key concept in many fields (Zuboff, 1988; Peters, 1988). For example, "knowledge does not simply foster wealth and power, in the age of knowledge it is wealth and power. By increasing our ability to master knowledge, we can each shape our individual destiny" (Kurzweil, 1991).

It follows therefore, that the role of the adult literacy practitioner is not to teach learners how to sound out words, but how to access knowledge. Since technology provides the means by which information can be acquired, technology is the solution. In a revisiting of Marshall McLuhan's "the medium is the message," the use of technology in adult literacy instruction is not the means to the end, but the end itself. This view is not widely understood or discussed, let alone accepted, in adult literacy circles. However, the growing emphasis on learner empowerment indicates that a new way of viewing learners and their needs will welcome a rethinking of the entire instructional process, what the content should be, and how it will be delivered.

FINAL THOUGHT

Zuboff, in *The Age of the Smart Machine*, writes:

> Choices that appear to be merely technical will redefine our lives together...a powerful new technology, such as that represented by the computer, fundamentally reorganizes the infrastructure of our material world. It eliminates former alternatives. It creates new possibilities. It necessitates fresh choices (1988, p. 5).

Turkle, writing in *The Second Self,* states, "Technology catalyzes changes not only in what we do but in how we think. It changes people's awareness of themselves, of one another, of their relationship with the world" (1984, p. 13).

Those concerned about adult literacy and technology must provide leadership in making choices and addressing change. The creation of a global community where information can be readily accessed by all, is a vision shared by many. Adult literacy professionals who embrace the use of technology, understand its potential, and are mindful of its limitations, can make this vision of the world a reality.

REFERENCES AND GENERAL BIBLIOGRAPHY

Anderson, J. (1991). *Technology and adult literacy*. New York: Routledge.

Andres, Y. (1991). Telecomputing and the shift of power. *FrEdMail News*. 2-3.

Aron, H. (1982, December). The impact of computers on literacy. *Lifelong Learning: The Adult Years*, 8-23.

Askov, E. (1985). *Adult literacy courseware development*. Paper prepared for the Institute for the Study of Adult Literacy, Pennsylvania State University: University Park, PA.

Askov, E., & Turner, T. C. (1989). Using computers for teaching basic skills to adults. In *Lifelong Learning: An omnibus of practice and research, Vol. 12*, (No. 6.)

Beder, H. (1991). *Adult literacy: Issues for policy & practice*. Malaber, FL: Kreiger Publishing Company.

Berterreix, J. L. (1990). Computers and literacy: The LABO project. In J. P. Hautecoeur (Ed.), *Alpha 90: Current research in literacy*. Hamburg, Germany: UNESCO Institute for Education.

Bitter, G., & Camuse, R. (1984). *Using a microcomputer in the classroom*. Reston, VA: Reston Publishing Company.

Blanchard, J. (1990, Spring). Hyperapplications: Implications for reading and writing. In *Adult Literacy & Technology Newsletter*. Available through ERIC system.

Bredemus, C. (1990). Technology for the 90s: Where we're at; where we're going. In T. C. Turner & E. Frick (Eds.) *Use of technology in adult literacy: Minnesota's programs*. Minneapolis, MN: MACAE, University of Minnesota.

Burke, J. G., & Eakin, M. C. (1979). *Technology and change*. San Francisco, CA: Boyd & Frasier Publishing Company.

Carter, J. (October, 1984). Instructional learner feedback: A literature review with implications for software development. *The Computing Teacher*. 53-55.

The case for computers. (1985, November). Reprinted from BCEL Newsletter. In *Conference on Adult Literacy and Computers*.

Castell, S., & Luke, A. (1987, May). Literacy instruction: Technology and technique. *American Journal of Education*. 413-440.

Chisman, F. P. (1989). *Jump start: The federal role in adult literacy*. Southport, CT: Southport Institute for Policy Analysis.

Cohen, V. B. (January, 1985). A reexamination of feedback in computer-based instruction: implications for instructional design. *Educational Technology*. 33-37.

Cook, W. D. (1977). *Adult literacy education in the United States*. Newark DE: International Reading Association.

Cole, J. L. (1971). *The application of computer technology to the instruction of undereducated adults*. Final Report. Raleigh, NC: North Carolina State University, Adult Learning Center. (ERIC Document Reproduction Service No. ED 056 304).

Cross, K. P. (1988). *Adults as learners*. San Francisco: Jossey-Bass.

Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920*. NY: Teachers College Press.

Darkenwald, C. G. (1986). *Adult literacy education: A review of the research and priorities for future inquiry*. New York: Literacy Assistance Center, Inc.

D'Ignazio, F. (1992, October). Teaching, learning, and the transformation of knowledge. *The Computing Teacher*, 54-55.

Duffy, T., & Bowen, B. A. (1986). *Technology applications in adult literacy instruction*. Pittsburgh, PA: Carnegie Mellon University.

Elmer-Dewitt, P. (1991, October). The world on a screen. *Time*, 80-82.

Enabling the future: Linking science and technology to societal goals. (1992, September). A Report of the Carnegie Commission. New York: 10 Waverly Place, NY.

Fingeret, A. (1984). *Adult literacy education: Current and future directions*. ERIC Information Series No. 284.

Fingeret, H. A. (1991). Meaning, experience, and literacy. *Adult Basic Education*. *1*(1).

Fleischman, J. (Ed.) (1990). The role of instructional technology in correctional education. *The Journal of Correctional Education 41*(2).

Gardner, H. (1991). *The unschooled mind: How children think and how schools should teach*. New York: Basic Books.

Gaynor, P. (November, 1981). The effect of feedback delay on retention of computer-based mathematical material. *Journal of Computer Based Instruction 8* (2), 28-34.

Going on-line: Creating a new avenue of communication for adult education. Promotional paper describing OTAN. Available through: Hacienda La Puente Adult Education, 15377 E. Proctor Ave. City of Industry, CA, 91745.

Golub, L. S. (1973). A CAI literacy development program for career-oriented youth. Pennsylvania State University, University Park, PA. (ERIC Document Reproduction Service No. ED 079 950).

Guellette, D.G. (Ed.) (1982). Microcomputers for adult learning: Potential and perils. Chicago: Follett Publishing Company.

Hilgard, E. R., & Bower, G. H. (1976). *Theories of learning*. Englewood Cliffs, NJ: Prentice-Hall.

Hunter, C. S., & Harmon, D. (1985). Adult illiteracy in the United States. New York: McGraw Hill.

Johnson, R. M. (in press). Evaluating a demonstration program: The technology for literacy project. In *Evaluation for foundations: Concepts, cases, guidelines and resources*. Jossey-Bass Publishing.

The KET Instructional Video Catalog. (1992). Lexington, KY: KET Enterprises.

King, R. (1992). *Using computers in family literacy programs*. National Center for Family Literacy, Louisville, Kentucky.

Knoblauch, C. H. (1990). Literacy and the politics of education. In A. A. Lunsford et al. (Eds.) *The right to literacy*. New York: The Modern Language Association, 80.

Knowles, M. (1973). *The adult learner: A neglected species*. Houston: Gulf Publishing Company.

Knutson, R. (1992). *Delivery of instruction to prisoners using interactive television*. Unpublished manuscript. Minnesota Department of Corrections.

Kozol, J. (1985). *Illiterate America*. New York: Doubleday.

Kruidenier, J. R. (in press). *The adult education learner as consumer: Increasing private sector involvement in adult literacy technology*. Philadelphia, PA: National Center on Adult Literacy, University of Pennsylvania.

Kurzweil, R. (1990). *The age of intelligent machines*. Cambridge, MA: MIT.

Kurzweil, R. (1991, September). The futurecast: The age of knowledge. *Library Journal*. 58-59.

LEAP (Literacy for Every Adult Project). (1986). *Report of the learning center component*. Richmond, CA: Richmond Public Library.

Learning keys. (1992, Summer). Baltimore, MD: Baltimore Reads, Inc.

Lewis, D. R., Stockdill, S. J., & Turner, T. C. (1990). Cost-effectiveness of micro-computers in adult basic reading. *Adult Literacy and Basic Education 14*(2), 136-149.

Lortie, D. C. (1975). *Schoolteacher: A sociological study*. Chicago: University of Chicago Press.

Main, C., & Whitaker, C. (1991). *Automating literacy: A challenge for libraries*. NY: Greenwood Press.

Meierhenry, W. C. (1982). Microcomputers and adult learning. *Adult Learning*. Chicago: Follett.

NCI reports captioned television is fun, effective motivator for students learning reading, language skills. (1988, December). Falls Church, VA: National Captioning Institute.

Newman, A. P., & Beverstock, C. (1990). *Adult literacy: Contexts & challenges*. Newark, DE: International Reading Association, 70-71.

Nickse, R. S. (1981). *The case for use of micro computers in adult basic education*. Paper prepared for the National Advisory Council on Adult Education. West Springfield, MA: Massachusetts Dept. of Education.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Park, R. J. (1987, Fall). Teaching literacy: Three approaches to improving literacy levels. *Educational Horizons*.

Patton, M. Q. (1987). Summative external evaluation. In T. C. Turner & S. H. Stockdill, (Eds.), *The technology for literacy project evaluation* (p. 47). (ERIC Document Reproduction Service No. ED 295 028.

Peters, T. (1988). *Thriving on chaos*. New York: Alfred A. Knopf.

Postman, N., & Weingartner, C. (1973). The reading problem. In *The school book*. New York: Delacorte Press.

Power on! New tools for teaching and learning. (1988). Office of Technology Assessment, Congress of the United States.

Que's computer user's dictionary. (1992). Carmel, IN: Cue Corporation.

Reder, S. (Summer, 1992). Programming adult literacy: Developing individuals and contexts. *NCAL Connections*. Philadelphia, PA: National Center on Adult Literacy, University of Pennsylvania.

Roueche, J. E., & Snow, J. J. (1987). *Overcoming learning problems: A guide to developmental education*. San Francisco: Jossey-Bass Publishing.

Rheingold, H. (1991). *Virtual reality*. New York: Simon & Schuster.

Sales, G. C. (1989, May). Applications of videodiscs in education. *The Computing Teacher*. 27-29.

Schlechty, P. C. (1976). *Teaching and social behavior: Toward an organizational theory of instruction*. Boston: Allyn & Bacon, Inc.

Sherry, M. (1992). The new ILSs: branching out. *Technology & Learning 13*(2), 16-29.

Sivin-Kachala & Bialo,-Kachala, J. P., & Bialo, E. R. (1992, June). *Software for adult literacy: Scope, suitability, available sources of information, and implications for federal policy*. Contractor report prepared for the Office of Technology Assessment, Congress of the United States.

Sticht, T. G. (1988). Research related to adult literacy education. In E. Z. Rothkopf (Ed.), *Review of research in education, 15*. Washington, DC: American Educational Research Association.

Turner, T. C. (1984). Designing technology centers for illiterate adults. In *Technology for disabled persons*. Conference Papers, University of Wisconsin-Stout, Menomonie, WS.

Turner, T. C. (1988a). Using the computer for adult literacy instruction. *Journal of Reading 31*(7), 643-647.

Turner, T. C. (1988b). An overview of computers in adult literacy programs. *Lifelong Learning 11*(8), 9-12.

Turner, T. C. (1991). The global community: Education through technology. *Community Education Journal 18*(3), 607.

Turkle, S. (1984). *The second self: Computers and the human spirit*. New York: Simon & Schuster.

Vacc, N. N. (1984). Computers in adult education. *Lifelong Learning 7*(6), 26-28.

Venezky, R. L., Wagner, D. A., & Ciliberti, B. S. (1990). *Toward defining literacy*. Newark, DE: International Reading Association.

Worthy, J. C. (1987). *William C. Norris, Portrait of a maverick*. Cambridge, MS: Ballinger Publishing Company.

Zuboff, S. (1988). *In the age of the smart machine*. New York: Basic Books.

Appendix

Table 1. A Comparison of Integrated Learning Systems and Curricular Systems A–iii

Figure 1. Uses of Technology in Adult Literacy Programs A–vi

Table 2. Matching Program Needs With Software A–vii

Table I. A Comparison of Integrated Learning Systems and Curricular Systems

	Stands for/Named for	Source/Distribution	Origin/Development/ Revision
PLATO 2000	• Originally: Programmed Logic for Automated Teaching Operation. • Now: Classic Teacher and Philosopher	TRO Learning, Inc. 4660 West 77th St. Edina, MN 55435 (800) 869-2000 FAX: (612) 832-1270	• 1980 TRO Purchase • 1979-William Norris-Control Data Corp. U. of Illinois • Ongoing revision & additions
CCC	Success Maker	Computer Curriculum Corporation 1287 Lawrence Station Rd PO Box 3711 Sunnyside, CA 94088 (800) 227-8324 FAX (408) 745-1766	• 1967-Patrick Suppes, Stanford U. • Strong research base • Ongoing revision and additions. • Acquired by Paramount Communications., Inc., 1990
JOSTENS	INVEST IN THE FUTURE (actual title)	Jostens Learning 7878 North 16th Street Phoenix, AZ 85020-4402 521-8538, 1-800-422-4339 FAX 1-602-230-7034	• Merger of companies E.S.C., Prescription Learning, Hartley, WICAT, & others • (1989) Acquisitions rather than product revision
PALS	Principals of the Alphabet Literacy System • Learning lab including interactive video	IBM/EduQuest 4111 Northside Pkwy Atlanta, GA 55402 (800) 769-8322	• John Henry Martin • JHM Corp.(developer of Write to Read Program) • 1983 (developed) • 1987 (released) • 1992 (CD-ROM)
CCP	Comprehensive Competencies Program • Curriculum system including ILS options	US Basic Skills Investment Corporation 1700 Diagonal Rd, Suite 400 Alexandria, VA 22314 (800) 486-0087 FAX (703) 684-1276	• Robert Taggert/ Remediation & Training Institute. 1983, ongoing revision. • Program model development and replication supported by the Ford Foundation.

	Target Populations	Curriculum Content	Instructional Hours
PLATO 2000	• Designed for teens and adults; skills range from K-12. • Major emphasis- workforce education, CBO, JTPA, corrections, community college	Reading, Math, Language Arts/Writing Science, Social Studies, Computer Awareness, Life Skills, GED, Parenting skills, Substance abuse, Business skills	• I can read = 400 hours • PLATO hrs = 1000 • Distributed courseware =1000 • Total = 2000
CCC	K-12 and adult learners	Math, Reading, Language Arts/Writing, Science, ESL, GED Prep, Life Skills, Computer Literacy.	• Approx. 3000 hours of instruction • Over 40 courses
JOSTENS	• Varies depending upon original developer. • Some specifically for adults.	Basic literacy, ABE, GED prep., ESL, writing, language, arts, workforce	Over 2000 total hours
PALS	• 0- 5th grade reading level; • Originally designed for potential high school dropouts.	• Reading and writing by recognizing different "phonemes." • Learn to touch type on personal computers.	• 1 hour per day, 20 weeks • 100 hours
CCP	Adults in need of basic skills—workers, unemployed, limited English speaking, etc. Also for educationally disadvantages youth.	Academic and functional skills: math, reading, language skills, writing, social studies, science, citizenship, ESL, employability, consumer economics, health & family.	Self-paced system, generally 1-2 reading or math grade gains in 30-34 hours of instruction, 614 lessons

Table I (continued). A Comparison of Integrated Learning Systems and Curricular Systems

	Features/Options	Hardware	Typical Purchase
PLATO 2000	• Interactive voice components delivered through CD-ROM • Remote access for distance delivery to multi-campus and correctional facilities. • *Features* and *other* facilities or system. • Inst/control of learning sequence.	• MS-DOS compatible, LAN or CD-ROM stand alone MS-DOS compatible. • Optional turnkey capability	• File server and 8 work stations plus courseware • Courseware also available separately
CCC	• Dial a Drill using telephone • Sound capability • Delivery at multiple sites • Multi-language, distance • Including courses in: Spanish, Hmong, Chinese, Arabic, Italian, Japanese	• Windows or Macintosh • Apple, IBM, Tandy, Dell, and Zenith • Networked: lab or distributed in classrooms • Stand-alone, CD-ROM student workstation	• 32 station networked lab or distributed model, including hardware and software. • 6,000 for a stand-alone student workstation, including hardware an d software • Over a three-year period, approx. $1 per student per day.
JOSTENS	• Open-entry/open exit system, sound • Hint screens, vocabulary windows, on-screen calculators, on-line tests, multi-media. • Encyclopedia- Compton's (Electronic version of Merriam Webster International Dictionary)	• MS-DOS plus • Windows, Apple II, & Macintosh • ILS	ILS network system- 4 work stations plus stand alone
PALS	• Interactive video disc, Touch-screen technology of IBM • Sound and pronunciation cues. • CD-ROM or laser	• Not networked • IBM PS2-86 and above • Audio playback, M-Motion	PALS Lab includes: • Student • 4-IBM PS 2 systems • 8-IBM PS/2 • PALS work journals • PALS teachers manuals • PALS wall charts • Typing manuals
CCP	• Print-based. • Assessment/diagnostic materials. • Easy to modify. • Multiple options in terms of: instructional. material; commercially available print, video and CAI supplements; management and authoring software; and equipment. • Annual nat'l conference, regional workshops, membership benefits.	• MS-DOS • May or may not be networked • Turnkey available • Instruction does not require computers.	Self-contained course for $300 can serve 8-12 learners simultaneously; computer-ready

Table I (continued). A Comparison of Integrated Learning Systems and Curricular Systems

	Minimum Cost	Learning Theory	Management System Capabilities
PLATO 2000	$49,500	• Competency-based • Sequential skill • Mastery learning • Problem solving software	• Management- performance report showing, mastery/achievement • 3rd party software
CCC	$17,000	Outcome-based education, whole language, cooperative learning, NCTM standards.	• Time, achievement prediction (IPS), • Diagnostic and custom reports
JOSTENS	Equipment $12,581 Software $22,800 Educational Services $7,800	Differing audiences targeted due to differing original developers.	• Placement testing, learner and program management, network management, time on task, lesson objectives mastery. • Materials correlated to JTPA job skills
PALS	$35,000- 50,000	Holistic approach: Integration of writing and reading	Manual
CCP	• Subject curriculum packages from $300-$1100 • Print, CAI, or videotape supplements for each subject from $200-2250. • Example: HS/GED Lab (30 people at a time, 5 subjects) approx. $40,000. • Nonprofit organization, operational costs underwritten by Ford Foundation	•Competency-based, individualized, self-paced instruction. •Program designed to accommodate learners of different ages, at different skill levels, with various learning needs	Combination paper-based and automated system for tracking instruction and test results, collecting participant characteristics, scoring tests, and analyzing and reporting individual and aggregate results.

	Support Systems and Materials	New Product Development
PLATO 2000	• Training- 5 days • Toll free hot-line • Including remote software diagnostics via modem • Software updates • Local educational specialists • Alignment to site curriculum and/or standardized objectives	• PLATO 2000+ to be released spring 1993. All new graphics. • Pre + post tests matching Dept. of Labor competencies for correspondence PLATO curriculum.
CCC	• Implementation and site planning • Staff training and development • Field engineers for installation and maintenance • Toll-Free hot-line • Can use 3rd party software	• Virtual Biopark, Smithsonian • Reading Adventures • Bravo! Books • Math Investigations • Amazonia, Smithsonian • Choosing Success
JOSTENS	• On-going staff development, modem support • Toll-free help-line • Technical support • Capable of running 3rd party software and integrating into management system/.	Full motion video
PALS	• In-service training and implementation support for teachers and administrators • 1 Day	Ongoing
CCP	Support systems Competencies correlated with state objectives including: CA, TX, NY	Ongoing additions and curriculum enhancements.

Figure 1. Uses of Technology in Adult Literacy Programs

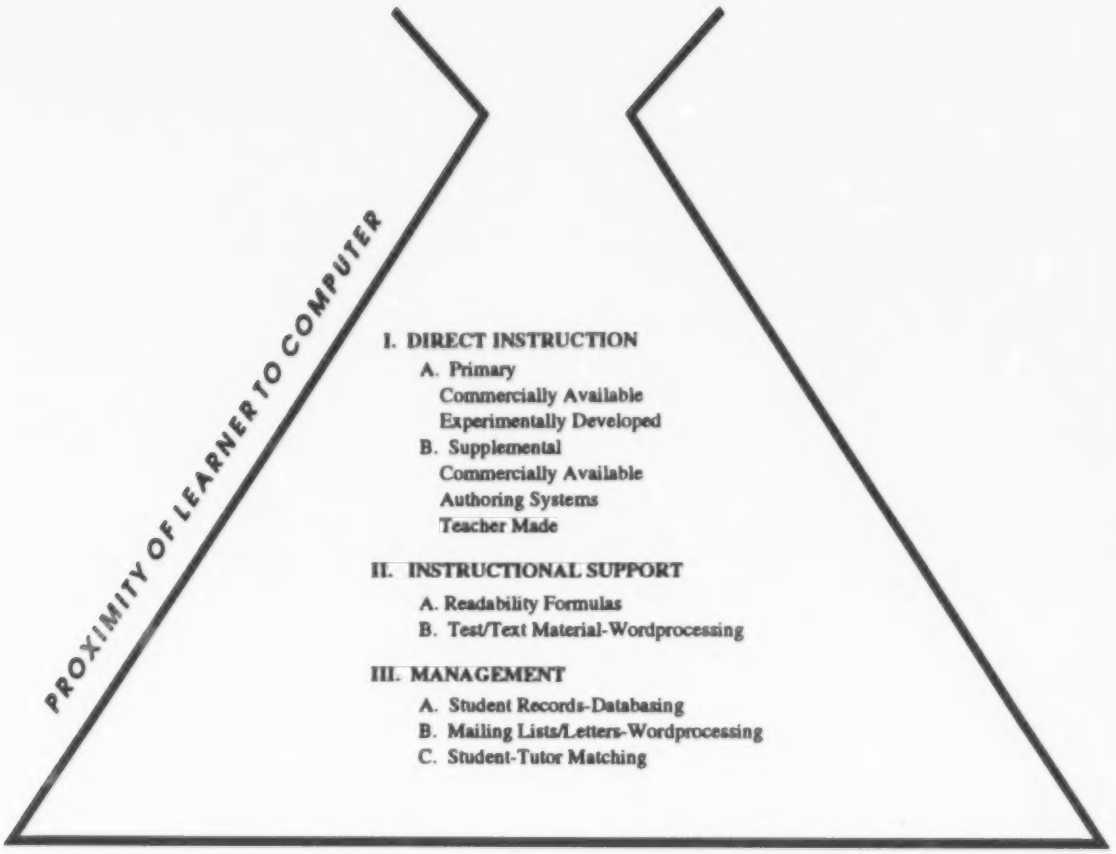

Table 3. Matching Program Needs With Software

Context/Resources	Software to Consider	Examples of Software
Volunteer program with lots of volunteers, very little money	Simple, flexible authoring programs to generate your own software and print materials	*Matchmaster* by Research Design Associates *Blank-it* by Intellimation *Word Search* by Hartley
Literacy program with little time for development of materials and curriculum, some $	Good, ready-made commercial software	*Mavis Beacon Teaches Typing* by The Software Toolworks *A Day in the Life* by Curriculum Associates *Word Attack* by Davidson & Assoc.
Reluctant learners	Games, motivational programs	*Sim City* by Maxis *Meteor Multiplication* by DLM *Alge-Blaster* by Davidson & Assoc.
$0 for software	Public domain software Exercises w/word processing	*Hang Man* and spelling games *Learning Keys* by Baltimore Reads
Grant received for one-time purchases	Software that will give you mileage—proven commercial software	*New Reader's Bookstore* by Interactive Knowledge *Math Sequences* by Milliken *Beyond Words* by Glencoe
Method-specific literacy program (e.g., program that uses Laubach or language experience method)	Authoring systems that allow you to tailor lessons to your methods & sequence of instruction OR If you're lucky commercial software developed for your method	*MacLang* by Intellimation *Spellavator* by MECC *My Words* by Hartley *Discover Intensive Phonics* by HEC Software
Mega-dollars granted	Comprehensive curriculum packages	*Invest* program by Jostens *PLATO* by The Roach Organization *English Express* by Davidson & Assoc. *CCC* by Computer Curriculum Corp.

Claudia Bredemus, Technology for Literacy Center, 1993